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Perceived physical competence towards physical activity, and motivation and enjoyment in physical education as longitudinal predictors of adolescents' self-reported physical activity

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Abstract

Objectives: The aim of the study was to investigate if adolescents' perceived physical competence towards physical activity (PA), and autonomous motivation and enjoyment in physical education (PE) during early adolescence can predict amount and intensity of self-reported physical activity six years later.

Design: This study utilized a 6-year longitudinal data set collected within Finnish school settings. Students responded to questionnaires measuring their perceived physical competence towards physical activity, and autonomous motivation and enjoyment in PE during their first year at middle school (Grade 7), and their PA engagement during their last year in high school (Grade 12).

Methods: A sample of 333 students (200 girls, 133 boys; M age = 12.41, years, $SD = .27$) participated in the study. Perceived physical competence in physical activity was assessed by the sport competence dimension of the Physical Self-Perception Profile, autonomous motivation in PE was assessed by the Sport Motivation Scale and enjoyment in PE by the Sport Enjoyment Scale. Students' self-reported metabolic equivalent (MET) and PA intensity (light [LPA], moderate [MPA], vigorous [VPA]) was calculated from the short form of International Physical Activity Questionnaire.

Results: Perceived physical competence towards physical activity significantly predicted total METs ($\beta = .28$), MPA ($\beta = .18$) and VPA ($\beta = .29$) six years later. Autonomous motivation and enjoyment in PE at Grade 7, however, were not significant predictors of later PA.

Conclusions: The results of this study support the proposition that self-perception of an individual's abilities arising from interactions with the environment related to PA during early puberty has an influential effect on later PA behaviour.

Keywords: physical activity; motivation, enjoyment; competence; physical education

33 1. Introduction

34 The health benefits from the optimal amount and intensity of physical activity (PA)
35 are considerable for school-aged children.¹ The current recommendations on health-
36 enhancing PA focus on sufficient amount and intensity of PA, suggesting that children and
37 adolescents should participate in at least 60 minutes per day of moderate or vigorous
38 intensity PA (MPA or VPA). Habitual PA is commonly conceptualized as “*any bodily*
39 *movement that results in energy expenditure*”.² This study operationalized and measured PA
40 based on amount as indicated in metabolic equivalents (METs), and different intensity levels,
41 that are light (LPA), moderate (MPA), and vigorous (VPA) intensities.

42 Adolescence is an important period when individuals may adopt a physically active
43 lifestyle.³ Adolescents engage in PA experiences within different contexts such as school
44 physical education, sport clubs, and being active with their families and peers. All these
45 encounters shape their own self-competency perceptions within activities related to PA. In
46 fact, systematic reviews have surmised that positive perceived physical competence towards
47 PA is one of the most important correlates of PA during adolescence.^{4,5} A widely applied
48 description of perceived competence is an assessment of personal ability that generalizes
49 across domains, such as physical activity, scholarship, or work.⁶ In this study, perceived
50 competence is explained as the perception of individual's abilities cumulating from
51 interactions within different PA environments.⁷

52 School physical education (PE) is an important context promoting positive PA
53 experiences among youth because it involves access to a large adolescent cohort.⁸
54 Evidence-based PE programs in early adolescence can provide students with positive
55 motivational and affective experiences, which will promote their later engagement in PA.⁹ In
56 an effort to investigate this association, this study also examined the role of autonomous
57 motivation and enjoyment in PE in predicting later PA engagement.

58 The underpinning description of PE motivation in the current research utilized the
59 Goal Content Theory (GCT) which is a microtheory of the self-determination theory¹⁰.
60 According to the GCT, motivation exists on a continuum ranging from amotivation through

61 four types of extrinsic motivation (external regulation, introjected regulation, identified
62 regulation and integrated regulation) to intrinsic motivation.¹⁰ Descriptions of each regulation
63 are given in Table 1. The essential premise of the GCT is that the autonomy of an individual
64 increases towards the intrinsic motivation end of the continuum.¹⁰ Autonomy is detailed as a
65 quality of human functioning that involves the experience of choice and perception of internal
66 perceived locus of causality.¹⁰ Research has indicated that autonomous motivation (intrinsic
67 motivation, integrated and identified regulation) in PE is positively linked with adolescents'
68 PA engagement in PE¹¹, PA participation during leisure-time^{12,13}, and in total PA
69 participation¹⁴. In contrast, results reported in these studies revealed that non-autonomous
70 motivation (amotivation, external and introjected regulation) was negatively or not
71 significantly associated with these consequences.

72 Enjoyment can also be seen as an important positive motive for PA behavior.^{15,16}
73 Enjoyment is defined as a multidimensional construct incorporating excitement, affect, and
74 perceptions of competence. More specifically, it is defined as a positive affect related to
75 feelings of pleasure, liking and fun.¹⁷ Previous studies have demonstrated that enjoyment in
76 PE is linked with PA engagement in PE^{15,16} and leisure time^{5,16} within adolescent
77 populations.

78 Overall, this study is framed on previous empirical findings that indicated perceived
79 competence in PA, and PE motivation and enjoyment are significant antecedents of PA
80 participation during adolescence^{4,11,15}. It should be acknowledged that for this study
81 perceived competence reflects the general perception of ability in PA (i.e., PA contexts
82 including PE) whereas motivation and enjoyment specifically denote cognitive and affective
83 perceptions within the PE context. **In this study, competence was measured at the domain
84 specific level (general competence towards PA) because domain specific competence is
85 affected by many specific contextual competencies. For example, domain specific
86 competence in PA in general is affected by specific competencies in areas such as sport and
87 PE. Harter⁷ and Fox⁶ suggested that a person's self-worth is built upon hierarchical structure
88 of competencies in which specific competencies cumulate on more general competence. For**

89 example, different specific competencies in different PA areas contribute to general PA
90 competence. Enjoyment and autonomous motivation, instead, are constructs which are
91 considered to be context specific and it is recommended these are also measured and
92 analyzed in relation to the context representative of the research focus.¹⁸

93 Although students' perceived physical competence regarding PA and motivational
94 and affective experiences in PE are acknowledged as important correlates of PA^{4,11,15}, a
95 notable shortcoming of previous research is that there are no studies investigating if these
96 variables predict self-reported PA over the adolescent stage of human development.
97 Previous longitudinal research in the area has previously assessed similar PA related
98 characteristics in middle school students, across intervals of two to three years.^{13,14} As an
99 extension to these investigations, the aim of the current study was to examine if perceived
100 physical competence towards PA, and autonomous motivation and enjoyment in PE
101 measured at Grade 7 would predict a) total amount of PA (total METs) and b) the amount of
102 different PA intensities (LPA, MPA, VPA) of self-reported PA six years later. Sex was
103 controlled in the analyses as confounding variable. We hypothesize that perceived physical
104 competence towards PA and autonomous motivation and enjoyment in PE would positively
105 predict higher amount and intensity (MPA, VPA) type of PA engagement.^{4,12,16}

106 **2. Methods**

107 This study utilized the 6-year longitudinal data collected from schools located in
108 central Finland. Whereas the previously published study of Jaakkola et al.¹⁹ reported the
109 findings related to young adolescents' fundamental movement skills and physical fitness and
110 their later PA, the findings presented here are focusing on the examination of relationships
111 between students' motivational experiences in PE during their first year of middle school and
112 their PA engagement six years later. A convenience sample of 333 Grade seven students
113 (200 girls, 133 boys; *M* age = 12.41, years, *SD* = .27) was selected based on their middle
114 school affiliation. A cohort of 224 participants (67%; 149 girls, 75 boys) of the initial group
115 responded to questionnaires 6 years later. The Ethics Committee (Institutional Review

116 Board) of the local university along with students and their parents/guardians approved the
117 study.

118 The short form of the Finnish version of the International Physical Activity
119 Questionnaire (IPAQ)²⁰ was utilized to examine students' PA. IPAQ asked participants to
120 report frequency and duration of their LPA, MPA, and VPA performed in bouts greater than
121 10 minutes in length. Weekly minutes of LPA, MPA, and VPA were calculated separately by
122 multiplying the number of days/week by the duration on an average day. Reported minutes
123 per week in each category were weighted by a MET resulting in a PA estimate independent
124 of body weight, expressed in MET-minutes/week and computed by multiplying METs by
125 minutes/week. The short form of IPAQ has shown acceptable reliability and validity within
126 large scale research that investigated the measurement properties of the instrument in 12
127 countries.²¹

128 Perceived physical competence towards PA was measured by the Finnish version of
129 the sport competence dimension of the Physical Self-Perception Profile.²² Each of the five
130 items were rated on a five-point Osgood scale from (1) "I'm among the best when it comes to
131 athletic ability" to (5) "I'm not among the best when it comes to athletic ability". The individual
132 item stem of the scale was "What am I like?" Results presented by Gråsten²³ indicated that
133 the Finnish version of the sport competence dimension of the Physical Self-Perception
134 Profile has satisfactory reliability (Cronbach's alpha coefficient .90) and construct validity
135 (confirmatory factor analysis; TLI = .97, CFI = .98, RMSEA = .074).

136 Autonomous motivation in PE was assessed by the Finnish version of the Sport
137 Motivation Scale (SMS).²⁴ The SMS included five dimensions; intrinsic motivation, identified
138 regulation, introjected regulation, external regulation and amotivation. All subscales are
139 comprised of four items rated on a five-point Likert scale (1 = does not correspond at all... 5
140 = correspond exactly). The SMS had individual item stem of "Why I'm currently participating
141 in physical education?". The Relative Autonomy Index (RAI) as suggested by Vallerand¹⁸
142 was calculated using subscale scores of each dimension. The RAI was calculated by
143 weighting the scores of the each dimension as to derive a single score. Intrinsic motivation

144 (+2) and identified regulation (+1) positively. Introjected regulation and external regulation
145 were summed up and weighed negatively (-1). Amotivation was also weighed negatively (-
146 2). The score of the RAI indicates the amount of autonomy in an activity. It can be either
147 positive or negative; positive value reflects autonomous motivation whereas negative score
148 represents non-autonomous motivation. Previous research has shown that the Finnish
149 version of the SMS demonstrated adequate construct validity and reliability. More
150 specifically, the study by Gråsten²³ conducted in Finnish PE, supported reliability
151 (Cronbach's alpha coefficients of all motivational regulations above .70) and construct
152 validity (confirmatory factor analysis; TLI = .89, CFI = .90, RMSEA = .031) of the Finnish
153 version of the SMS.

154 Enjoyment in PE was analyzed by the Finnish version of the Sport Enjoyment
155 Scale.²⁵ The scale included four items (e.g., "I have fun in PE lessons") and it has the
156 individual item stem of "In my PE class". All items necessitated reporting on a five-point
157 Likert scale (1 = does not correspond at all... 5 = corresponds exactly). Gråsten²³ reported
158 that the Finnish version of the Sport Enjoyment Scale has satisfactory reliability (Cronbach's
159 alpha coefficient .93) and construct validity (confirmatory factor analysis; TLI = 1.00, CFI =
160 1.00, RMSEA = .031).

161 IBM SPSS Statistics for Windows, Version 22 (2013 SPSS Inc.; IBM Corp.; Armonk,
162 NY) were used for the analyses and only the data from students ($n = 224$) who responded to
163 both phases of the data collection were included. First, normality of the data and descriptive
164 statistics were assessed. Second, hierarchical multiple regression analysis were conducted
165 to test the predictive strength of perceived physical competence towards PA and
166 autonomous motivation and enjoyment in PE on MET, LPA, MPA, and VPA. Sex was set as
167 a covariate in the analyses (females were coded as 0 and males 1) and it was entered as
168 the first step in the hierarchical regression analysis. Perceived physical competence towards
169 PA and autonomous motivation and enjoyment in PE were set on the second step in the
170 analysis.

171 **3. Results**

172 Details of the mean values, standard deviations, and correlations associated with the
173 study variables are represented in Table 2. Normality analyses showed that skewness and
174 kurtosis values ranged within the limits of -2 to +2. Pearson' product moment correlation
175 coefficients showed that perceived physical competence towards PA correlated positively
176 and significantly with METs, MPA, and VPA. The relationship was strongest for higher
177 intensity PA. Enjoyment in PE was positively and significantly related to perceived physical
178 competence towards PA, autonomous motivation in PE, MET, and VPA, and autonomous
179 motivation in PE was related to perceived physical competence towards PA.

180 The results of hierarchical multiple regression analyses specifying the predictive
181 strength of perceived physical competence, enjoyment, and autonomous motivation on PA
182 (after accounting for participants' sex) are presented in Table 3. Sex had a statistically
183 significant explanatory strength only for VPA, indicating that boys were engaged more in
184 VPA. Secondly, PE enjoyment and autonomous motivation did not have a statistically
185 significant role in predicting any of the PA variables. Subsequently, perceived physical
186 competence towards PA predicted MET ($\beta = .28$), MPA ($\beta = .18$) and VPA ($\beta = .29$). Finally,
187 the practical significance of the results was assessed by examining R^2 s. The predictor
188 variables did not have a significant effect on LPA but had a weak effect on students' MET
189 ($R^2 = .12$), MPA ($R^2 = .06$), and VPA ($R^2 = .15$) six years later.

190 **4. Discussion**

191 The aim of the study was to investigate the extent to which perceived physical
192 competence towards PA, and autonomous motivation and enjoyment in PE during early
193 adolescence predict PA engagement six years later. The current results extend knowledge
194 drawn from previous cross-sectional research^{4,5,12,13} that investigated the relationships
195 between students' motivational experiences and later PA participation through adolescence.
196 The results of the current study revealed that perceived physical competence towards PA
197 measured at Grade 7 was the only statistically significant predictor of later PA engagement.
198 More specifically, it predicted total METs, MPA and VPA. Although significant associations
199 were found, it should be noted that the beta coefficient values were small. Additionally,

200 results of this study indicated that autonomous motivation and enjoyment in PE measured at
201 Grade 7 did not predict PA six years later.

202 The main finding of the study was that perceived physical competence towards PA
203 predicted amount and intensity of PA, supporting the correlational findings of previous
204 research.^{4,5} This finding is in line with Harter's⁷ competence motivation theory that proposed
205 individuals with high perceived competence persist longer in physical activities in
206 comparison to individuals who do not perceive themselves as competent. This current result,
207 therefore, support Harter's⁷ theoretical assumption showing that positive perception of
208 students' abilities arising from interactions with the PA environment in early puberty have
209 long lasting effects on PA behaviour later in adolescence. Interestingly, perceived physical
210 competence towards PA predicted VPA and MPA but not LPA. Adolescents with higher
211 perceptions of physical competence towards PA are likely to be engaged in recreational and
212 organized sports and more likely exposed to additional opportunities for vigorous activity.
213 These findings are also consistent with the limited level of physical competency necessitated
214 by LPA, as it mainly consists of walking or other low intensity physical activities. Considering
215 the greater health benefits of high and moderate intensity PA compared to light intensity
216 PA²⁶, continuing efforts to increase adolescents' perceived of competence towards PA are
217 warranted.

218 The results of this study also demonstrated that autonomous motivation and
219 enjoyment in PE did not significantly predicted students' later PA engagement, whereas
220 previous cross-sectional studies have shown PE motivation^{12,13} and enjoyment^{15,16} to be
221 related to engagement in PA. It may be that motivational and enjoyable events experienced
222 in PE do not have a longitudinal effect on their PA due to changes in PE contexts. Although
223 the relationship pattern, whereby motivational experiences may transfer across different
224 contexts (e.g., between PE and exercise contexts)²⁴ has been supported in previous
225 research, the findings observed in the current results infer that PE experiences at the high
226 school level over shadow the experiences at early middle school level. Additionally, it should
227 be recognized that PE is only one possibility for adolescents to engage in experiences

228 related to PA. Other organized PA contexts, peers and families have roles in facilitating
229 adolescents' opportunities to participate in PA and extend their knowledge base regarding
230 PA.

231 Although physical competence towards PA in early adolescence was a significant
232 predictor of students' METs, MPA, and VPA, the sizes or effects were weak (adjusted R^2
233 ranging from 6% to 15%). Previous research, however, supports the influential role of
234 physical performance variables such as motor skills and physical fitness in PA engagement.
235 Barnett et al.²⁷ study demonstrated that 10-year-old students with proficient manipulative
236 skills had a 10–20% higher likelihood to be engaged in VPA when they reached 16 years of
237 age. Similar positive associations have been found between physical fitness measured in
238 childhood and PA data collected in adolescence.²⁸ Barnett et al.²⁷ have also shown that
239 perceived sport competence mediates the relationship between motor skill proficiency and
240 PA explaining 18% of the change in the variance of PA. Taking into account these previous
241 findings^{27,28}, and the complex web of determinants that lead to PA participation, the
242 magnitudes of effect sizes are understandable.

243 This study extends the findings of previous school related PA research through the
244 examination of the longitudinal contribution of students' perceived PA competence and the
245 psychological characteristics associated with participation in PE, to their self-reported PA
246 engagement, intensity of PA, and total amount of PA during the last phase of high school.
247 Although this study revealed that autonomous motivation and enjoyment in PE were not
248 significant predictors of later PA engagement, previous researchers have demonstrated
249 relationships between these variables^{4,5,12,13}, and support should remain for further
250 investigation of the important role of autonomous motivation and enjoyment in PE on general
251 PA. Future studies are also needed to further clarify the role of perceived physical
252 competence as a possible mediator between PE motivation and enjoyment and PA.

253 A limitation of this study is the use of the self-report format to analyse PA
254 engagement. Scholars have advocated the use of objective methods, such as
255 accelerometers and pedometers to strengthen the legitimacy and generalizability of the

256 claims made in relation to adolescent PA behaviour.²⁹, It should be acknowledged, however,
257 that the validity and reliability of the IPAC has been shown to be acceptable when measuring
258 children's and adolescents' PA.²⁰

259 **5. Conclusion**

260 Our findings highlight the role of perceived PA competence of children in the early stages of
261 puberty as a predictor of their daily METs, MPA, and VPA as older adolescents. Specifically,
262 young adolescents' perceptions of physical competence, arising from interactions within the
263 social environment related to PA contexts, have a long lasting influence on high intensity PA.
264 Results of this study also demonstrated that although PE programs aim to promote a
265 physically active lifestyle through motivating and enjoyable experiences, these occurrences
266 are not necessarily effective in promoting PA in young adulthood.

267 **6. Practical implications**

- 268 • PE teachers should continue to concentrate on providing positive experiences of
269 engaging in physical activity to enhance students' physical competence.
- 270 • PE classes that focus on adolescents' perceived physical competence should be
271 implemented based principles such as emphasising self-development, effort, co-
272 operation and learning outcomes.
- 273 • Special attention should be directed towards facilitating adolescent girls VPA.

274

275 **Conflict of interest**

276 No competing agreements, professional relationships and financial interests existed where a
277 third party may benefit from the presented results.

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- 352

353 Table 1. Definitions of motivational regulations.

Motivational regulation	Definition
Intrinsic motivation	Pleasure and satisfaction resulting from participation regulate behavior.
Integrated regulation	Behavioral regulation when a person has integrated and accepted behavior with other aspects of the self (coherence with other aspects of person's goals and values). For example, perception that physically activity lifestyle is part of me.
Identified regulation	Behavioral regulation when the individual has accepted values and goals of behavior. For example, perception that I want to be physically active.
Introjected regulation	Esteem-based pressures regulate behavior. For example, avoidance of shame or worry about self- and other approval.
External regulation	External factors regulate behavior. For example, constraints, fear of punishments or rewards.
Amotivation	A state in which people lack motivation and intention to behave.

354 Table 2

355 Descriptive summary (n =224).

Variable list	1	2	3	4	5	6	7	8
<i>Criterion Variables</i>								
1 METs	-							
2 LPA	.59 ^{***}	-						
3 MPA	.63 ^{***}	.21 [*]	-					
4 VPA	.82 ^{***}	.15 [*]	.35 ^{**}	-				
5 Enjoyment	.18 ^{**}	.07	.11	.19 [*]	-			
6 RAI	.13	.04	.02	.15 [*]	.61 ^{***}	-		
7 Perceived competence	.29 ^{***}	.10	.14 [*]	.31 ^{***}	.53 ^{***}	.22 [*]	-	
8 Sex	.16 [*]	.04	-.04	.23 ^{***}	.15 [*]	.13	.18 [*]	-
<i>M</i>	4810.42	448.61	214.63	309.87	3.88	-.39	3.33	1.32
<i>SD</i>	2665.93	290.12	127.17	164.31	1.02	2.72	.87	.47
Range	148.50 - 15646	0 – 1980	0 - 900	0 - 1085	1 - 5	-8.82 - 5.67	1 - 5	1 - 2
Skewness	1.04	1.82	1.57	.71	-.67	-.27	-.31	na
Kurtosis	1.71	1.23	1.54	1.93	-.26	-.19	-.26	na

Note. *p < .05; ***p < .001. MET = metabolic equivalent; LPA = light intensity physical activity; MPA = moderate intensity physical activity; VPA = vigorous intensity physical activity, and RAI = relative autonomy index.

356

357

358 Table 3

359 Results of the hierarchical linear regression analyses.

Variable	MET					LPA				
	<i>B</i>	<i>B SE</i>	β	t-test	p-value	<i>B</i>	<i>B SE</i>	β	t-test	p-value
Step 1										
Sex	261.70	303.31	.06	.87	.388	-9.48	47.06	-.01	.18	.858
Adjusted R^2	.01		1			.00				
Step 2										
Enjoyment	46.86	172.18	.09	.27	.786	6.97	28.17	.02	.24	.805
RAI	-63.216	296.75	-.09	.93	.356	-4.31	10.59	-.04	.42	.686
Perceived Competence	645.07	200.19	.28	3.22	.001**	38.23	31.04	.11	1.17	.220
Total Adjusted R^2	.12					.01				
Variable	MPA					VPA				
	<i>B</i>	<i>B SE</i>	β	t-test	p-value	<i>B</i>	<i>B SE</i>	β	t-test	p-value
Step 1										
Sex	-32.82	20.08	-.12	-1.57	.119	52.60	24.72	.15	2.13	.035*
Adjusted R^2	.02					.03				
Step 2										
Enjoyment	13.27	13.25	.10	1.10	.271	12.38	14.79	.08	.41	.680
RAI	-5.86	20.08	-.12	1.30	.197	-3.20	5.56	-.05	.46	.647
Perceived Competence	27.12	13.25	.18	2.05	.042*	51.43	16.29	.29	3.16	.002**
Total Adjusted R^2	.06					.15				

360 Note. *p <.05,**p <.01. MET = metabolic equivalent; LPA = light intensity physical activity; MPA = moderate intensity physical activity; and VPA = vigorous intensity physical activity.