

CHAPTER 3. MEASURE DEVELOPMENT

Procedure for measure selection

Based on the IMPACT project methodology and the available related literature, each partner proposed a number of measures for the assessment of each construct that were classified in the following clusters:

- (1) Youth Physical Activity (PA),
- (2) Proximal determinants of youth PA,
- (3) Motivational outcomes in PE,
- (4) Pupil motivation and pupil-centred determinants of motivational outcomes in PE and PA,
- (5) PE teacher/class-centred determinants of motivational outcomes in PE and PA,
- (6) Socio-Economic Status (SES),
- (7) Demographic information.

All IMPACT project partners reviewed all measures and provided comments about the strengths and weaknesses of each measure. The measures and all comments were available to all partners for some time and finally all partners (the leader of each organization) voted which measure to select as the most appropriate for each construct. Based on this procedure, the following measures were selected.

Measure Development - Diagnostic Tools

Two versions of the measures were developed.

A. The **long IMPACT version** that can be completed approximately in 30 minutes. This includes the following scales:

1. Demographic information (gender, age, school, class in school, town, country, ethnicity),
2. Socio-Economic Status (i.e., SES; FAS Revised; 7 items; Torsheim, et al., 2016; FAS III; 1 item; Schnohr et al., 2008),
3. Frequency of Physical Activity (PA; the 2-item screening measure for PA - PACE+ Adolescent PA Measure; Prochaska et al., 2001),
4. Amount of PA (one item measuring hours per week spent in MVPA; Booth et al., 2001),
5. Youth Activity Profile (YAP; Saint-Maurice & Welk, 2014; 5 items capturing PA inside school, 5 items capturing out of school PA and 5 items assessing pupils' sedentary behaviors),
6. Motivational climate in Physical Education (PE; Papaioannou et al., 2007; 6 items for mastery climate, 6 items for performance approach and 6 items for performance avoidance climate),
7. Basic needs satisfaction in PE, consisted of three scales, Autonomy (Standage et al., 2005; 5 items), Competence (McAuley et al., 1989; 6 items) and Relatedness (Richer & Vallerand, 1998; 4 items),
8. Achievement goals in PE (Duda & Nicholls, 1992; 7 items for Task Orientation and 6 items for Ego Orientation),
9. Behavioral regulations of motivation in PE (BREQ 2; Markland & Tobin, 2004; 4 items for intrinsic motivation, 4 items for identified Regulation, 4 items for introjected Regulation, 4 items for extrinsic regulation and 4 items for amotivation),
10. Positive and negative affect in PE (PACES; Motl et al., 2001; 8 items for positive affect and 8 items for negative affect in PE),
11. Intentions to be active in leisure-time (Standage et al., 2003; 3 items),
12. Perceived behavioral control regarding PA (Hagger et al., 2009; Rhodes & Courneya, 2005; in total 3 items),
13. Attitudes towards PA (Hagger et al., 2009; 6 items),

14. Social support towards participation in out-of-school PA (Dewar et al., 2013; 4 items for Friend Support and 4 items for Family Support),
15. Self-Efficacy (Dishman et al. 2014; 5 items; Dewar et al., 2013; 1 item).
16. Self-monitoring (2 items from Sniehotta, et. al., 2005 and 2 adapted items from Theodosiou & Papaioannou, 2006; in total 4 items),
17. Action planning of out-of-school PA (4 items from Sniehotta et al., 2005 plus one item added by IMPACT researchers),
18. Subjective vitality (Ryan & Frederick, 1997; 5 items),
19. Barriers to PA (15 items selected from various instruments, e.g., Dishman et al., 2005; Gunnell, et al., 2015).

Motivational climate, basic needs satisfaction, achievement goals, behavioral regulations, positive and negative effect were used to assess motivation-related variables in PE and are considered **distal determinants** of out-of-school PA, while social support, self-monitoring, action planning, attitudes, intentions and perceived behavioral control were the **proximal determinants** of out-of-school PA. Self-reported PA and vitality were the main outcomes. Moreover, in the PE context, positive and negative affect were considered motivational outcomes.

B. The **short IMPACT measure** for the **diagnosis of inactivity** that can be completed in 5 minutes. It includes the Physical Activity (PA) items in the aforementioned paragraphs (3) and (4), sport involvement, intentions to be physically active in leisure-time, self-monitoring, demographic information (gender, age, school, class in school, country) and an open-ended question capturing the most important barrier to be physically active.

More details about the measures can be found on the IMPACT project website (www.impactpe.eu/site/index.php/en/measure/surveys).

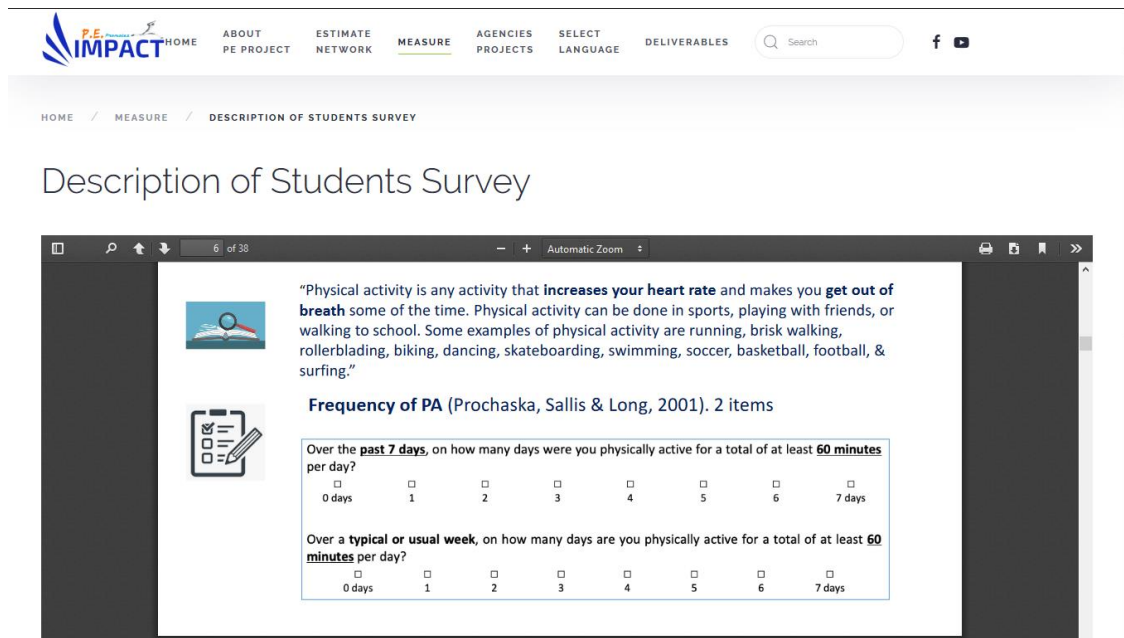


Photo 3.1. Description of Students' Survey in the IMPACTPE.EU website

Participants in Preliminary-Pilot Study

In spring 2018 a preliminary-pilot study was carried out to establish construct validity and measurement equivalence across six European countries of the IMPACT project measures. Participants ($n = 2271$) were PE pupils from France ($n = 219$ males, $n = 224$ females), Greece ($n = 145$ males, $n = 134$ females), Italy ($n = 190$ males, $n = 167$ females), Spain ($n = 238$ males, $n = 229$ females), Turkey ($n = 254$ males, $n = 233$ females) and UK ($n = 64$ males, $n = 74$ females). Their mean age was 13.70 ($SD = 1.55$).

Initially, ethical approval of the Universities' Bioethics Committees was taken and the Ministries of Education was asked where was necessary. Parents and students also gave their written consent. A back to back-translation procedure was used in countries where the scales had not been used in the past (e.g., Beaton et al., 2000; Harkness, 2003). All measures were delivered online during PE classes. Only 247 pupils of them, coming from Italy, completed the questionnaires by using paper and pencil (not online). They responded to a battery of widely-used questionnaires assessing:

Factor Structure and Invariance Analysis

An important aim of IMPACT project was to develop invariant measures across European countries of PA and motivation in PE and in PA. This would allow one to draw the same conclusions for each country as for the total European population of pupils based on findings stemming from these measures.

Table 3.1. Results of the measurement invariance tests across 6 countries

Variables	Number of Items	Number of Factors/ Latent Variables	Unconstrained		Metric inv.	Scalar inv.
			TLI	CFI	ΔCFI	ΔCFI
Physical Activity	8	4 (1H/3L)	.965	.982	.007	.085
Vitality	5	1	.915	.958	.008	.024
Intention, PBC, Attitudes	12	3	.953	.964	.004	.018
Planning & Monitoring	9	2	.960	.971	.002	.022
Social Support	8	2	.945	.963	.005	.022
Motivational Climate	13 (-5)	3	.900	.932	.008	.199
Mastery climate	6	1	.947	.977	.007	.045
Enjoyment	4	1	.952	.984	.008	.020
Self-efficacy	6 (-2)	1	.911	.940	.005	.104
Basic Needs Satisfaction	13 (-2)	3	.924	.940	.004	.020
Behavioural Regulations	19 (-1)	5	.909	.926	.003	.037
Achievement Goals	12 (-1)	2	.916	.932	.007	.014
Positive & Negative Affect	16	2	.930	.940	.007	.014

Note: In parentheses number of items excluded to achieve metric invariance; H = High-order factor; L = Lower-order Factor

Confirmatory Factor Analyses (CFAs) supported the factorial validity of the measures in each country, because Tucker-Lewis Indices (TLI) which is unaffected by sample size (Marsh et al., 1988) was above .90 as required (Table 3.1). Moreover, multi-group CFAs across six groups of data from 6 countries respectively supported metric equivalence across the six countries (FR, IT, GR, SP, TR, UK) because the ΔCFI for metric invariance was below .01 as required (Cheung & Rensvold, 2002) (Table 3.1). This allows summation of the data from all countries and investigation of correlations among

these variables in the entire sample in the same way as in separate samples of each country. However, scalar invariance was not supported, implying that one cannot draw conclusions based on differences in scale scores between countries.

Scale Reliability

All scales (except performance approach climate) had Cronbach's alphas above .70 across all countries, while the average level of alpha reliability across all scales was .86, indicating acceptable and good levels of reliability respectively (Table 3.2).

Table 3.2. Descriptives (for the total sample) and scale alpha reliabilities per country and total sample

Variables	M±SD	FRANCE	GREECE	ITALY	SPAIN	TURKEY	UK	TOTAL
Frequency of PA	3.39 ±1.88	.82	.90	.93	.90	.92	.90	.90
Mastery Climate	3.62±.87	.81	.82	.90	.79	.91	.89	.87
Perf. Approach Climate	2.70±.82	.68	.71	.74	.72	.71	.76	.69
Perf. Avoidance Climate	2.25±.88	.77	.80	.76	.69	.76	.87	.78
Autonomy needs satisf.	3.01±1.00	.73	.63	.77	.69	.87	.88	.80
Competence needs sat.	3.58±.93	.90	.88	.92	.85	.94	.96	.90
Relatedness needs sat.	3.29±.89	.74	.77	.79	.77	.90	.89	.82
Intrinsic Motivation	3.75±.99	.81	.85	.86	.88	.92	.96	.88
Identified Regulation	3.77±.94	.82	.79	.86	.82	.91	.93	.86
Introjected Regulation	2.53±.99	.77	.83	.70	.82	.82	.88	.79
Extrinsic Regulation	2.23±.98	.75	.87	.80	.80	.87	.89	.82
Amotivation	2.25±1.10	.90	.88	.89	.83	.77	.92	.86
Task Orientation in PE	3.76±.85	.90	.83	.91	.88	.93	.95	.90
Ego Orientation in PE	2.77±1.02	.83	.85	.88	.83	.86	.89	.86
Positive Affect in PE	3.71±.93	.95	.91	.93	.91	.97	.96	.94
Negative Affect in PE	2.10±.93	.90	.87	.89	.89	.92	.94	.90
Intention	4.51±1.90	.95	.93	.95	.93	.92	.93	.94
Perc. Behav. Control	4.80±1.65	.81	.79	.87	.79	.86	.89	.83
Attitudes towards PA	5.45±1.51	.94	.92	.94	.94	.94	.97	.94
Friend Support	3.07±.99	.80	.81	.79	.79	.84	.81	.81
Family Support	3.21±.99	.81	.81	.74	.77	.85	.81	.79
Action Planning	3.32±1.14	.92	.87	.91	.92	.94	.95	.92
Self-monitoring	3.17±1.14	.91	.82	.90	.88	.88	.93	.89
Vitality	3.54±.91	.88	.89	.87	.86	.92	.92	.89

Notes. PA: Physical Activity; PBC: Perceived Behavioral Control

Explanation of Physical Activity and Well-Being variance

Correlations of PA and well-being with proximal predictors of PA. As was expected, proximal predictors of PA had positive relationships of moderate size (Pearson correlations $r > .40$) with pupils' out of school PA and well-being variables (subjective vitality, positive affect in PE; Table 3.3). Vitality was also positively related to PA. The correlation of PA with Perceived Behavioral Control (PBC) was somewhat higher than the respective correlation between PA and self-efficacy. Because the PBC and self-efficacy are quite similar constructs and in order to further reduce the length of the entire measure, self-efficacy was not included in the following main studies.

Table 3.3. Correlation analysis of out of school self-reported PA and well-being variables with proximal predictors of out-of-school PA

Predictors of PA and well-being	Total Physical Activity	Subjective Vitality	Positive Affect	Negative Affect
Intention	.53**	.34**	.32**	-.22**
Perc. Beh. Control	.49**	.38**	.34**	-.25**
Attitudes	.41**	.40**	.43**	-.34**
Self-efficacy	.36**	.33**	.40**	-.09**
Friend Support	.43**	.43**	.35**	-.11**
Family Support	.43**	.44**	.34**	-.12**
Action Planning	.50**	.50**	.39**	-.18**
Self-monitoring	.49**	.50**	.41**	-.17**
Vitality	.36**	-	.53**	-.28**

Notes. Total Physical Activity = standardized (PA frequency score) + standardized YAP out of school PA score); PA: Physical Activity; YAP: Youth Activity Profile; ** $p < .001$

Correlations of PA and well-being with distal predictors of PA. The relationship of PE-related motivational variables with out-of-school PA was statistically significant ($p < .001$), positive and low, which is expectable because motivation in PE is distal predictor of out-of-school PA (Table 3.4). On the other hand, several of these variables (mastery climate, all needs satisfaction, intrinsic motivation, identified regulation, task orientation) had moderate to high positive correlations with positive affect in PE and moderate positive relationships with vitality. The variables that had non-significant or negative correlation with positive affect in PE were positively related to negative affect in PE, in line with theoretical predictions. In the next main studies performance approach climate and introjected regulation were excluded because their relationships with PA and well-being were weak and it was necessary to reduce the measure's completion time.

Table 3.4. Correlation analysis of out of school self-reported PA and well-being variables with PE-related motivational variables

Variables in PE	Total Physical Activity	Subjective Vitality	Positive Affect	Negative Affect
Mastery Climate	.12**	.34**	.53**	-.31**
Perform Approach Climate	.15**	.12**	.10**	.22**
Perform Avoidance Climate	.08**	-.01*	.03	.39**
Autonomy needs satisfaction	.16**	.28**	.42**	-.14**
Competence needs satisfaction	.35**	.43**	.59**	-.35**
Relatedness needs satisfaction	.22**	.41**	.56**	-.28**
Intrinsic Motivation	.31**	.45**	.78**	-.52**
Identified Regulation	.24**	.43**	.71**	-.43**
Introjected Regulation	.08**	.14**	.14**	.18**
Extrinsic Regulation	-.02	-.02	-.10**	.43**
Amotivation	-.07**	-.08**	-.24**	.57**
Task Orientation	.24**	.45**	.73**	-.39**
Ego Orientation	.20**	.14**	.17**	.19**
Positive Affect	.32**	.53**	-	-.50**
Negative Affect	-.16**	-.28**	-.50**	-

Notes. Total Physical Activity = standardized (PA frequency score) + standardized YAP out of school PA score); PA: Physical Activity; YAP: Youth Activity Profile; ** $p < .001$

Explanation of variance of PA and well-being. Separate hierarchical regression analyses were conducted, entering predictor variables in steps in line with the assumptions of the IMPACT project model (Figure 3.5). The results imply that most of the predictors contributed significantly in the explanation of variance of motivational outcomes, explaining in total 44% of out-of-school PA, 47% of vitality, 74% of positive affect in PE and 53% of negative affect in PE (Table 3.5). Moving from one step to the next the percentage of the explained variance significantly increased, providing support to the hierarchical structure of the model of the IMPACT project.

Table 3.5. Results from Hierarchical Regression Analyses

	Out of School PA		Vitality		Positive Affect in PE		Negative Affect in PE	
Predictors	ΔR^2	β	ΔR^2	β	ΔR^2	B	ΔR^2	β
Step 1	.05**		.06**		.04**		.01**	
Age		-.10**		-.18**		-.17**		.08*
gender		-.21**		-.17**		-.13**		.07
Step 2	.03**		.09**		.24**		.25**	
Mastery Climate		.10**		.27**		.47**		-.28**
Perf. Approach Cl.		.13**		.14**		.10*		.03
Perf. Avoidance Cl.		.00		-.10*		-.14**		.38**
Step 3	.08**		.10**		.18**		.07**	
Autonomy		.00		.06		.12**		-.05
Competence		.33		.24**		.37**		-.27**
Relatedness		.01		.15**		.10*		-.01
Step 4	.01**		.04**		.18**		.06***	
Task Orientation		.12**		.25**		.53***		-.28**
Ego Orientation		.05		.03		.00		.17**
Step 5	.01**		.01**		.08**		.16***	
Intrinsic		.04		.07		.41***		-.34***
Identified		.05		.14**		.09*		-.03
Introjected		.03		.03		.01		-.02
Extrinsic		-.03		-.01		-.01		.10*
Amotivation		-.08*		-.01		-.04		.33**
Step 6	.01**		.04***		-		-	
Positive affect in PE		.18**		.36**		-		-
Negative affect PE		.05		-.03		-		-
Step 7	.12***		.07***		.01**		.00	.00
Friend Support		.16**		.17**		.01		.03
Family Support		.30**		.17**		.06*		.02
Step 8	.07***		.04***		.00		.00	
Action Planning		.19**		.12**		.01		-.02
Monitoring		.18**		.18**		.07*		.00
Step 9	.06***		.01**		.01**		.00	
Intention		.23***		-.03		-.02		.00
Per. Behav. Control		.08*		.00		-.05		-.05
Attitudes		.06		.12***		.03		-.05
Self-efficacy		.06		.02		.09**		.02
Total R^2	.44***		.47***		.74***		.54***	

*** $p < .001$; ** $p < .01$; * $p < .05$