RICYDE. Revista Internacional de Ciencias del Deporte
ISSN: 1885-3137
ricyde@cafyd.com
Editorial Ramón Cantó Alcaraz
España

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Perceived Autonomy-Support Instruction and Student Outcomes in Physical Education and Leisure-Time: A Meta-Analytic Review of Correlates
RICYDE. Revista Internacional de Ciencias del Deporte, vol. XII, núm. 43, enero, 2016, pp. 29-47
Editorial Ramón Cantó Alcaraz
Madrid, España

RICYDE. Revista Internacional de Ciencias del Deporte
doi:10.5232/ricyde

Rev. int. cienc. deporte

RICYDE. Revista Internacional de Ciencias del Deporte
VOLUME XII - YEAR XII
Pages:29-47 ISSN:1885-3137
Issue 43 - January - 2016

http://dx.doi.org/10.5232/ricyde2016.04302

Perceived Autonomy-Support Instruction and Student Outcomes in Physical Education and Leisure-Time: A Meta-Analytic Review of Correlates

Percepción de la formación de apoyo a la autonomía y resultados en estudiantes en educación física y tiempo libre: Una revisión meta-analítica de correlaciones

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Abstract

Physical inactivity is a global concern. Physical educators have direct access to children. Researchers have investigated the benefits of student perceived physical education (PE) autonomy-supportive instruction in PE and leisure-time (LT). Hence, a fixed-effect meta-analysis was conducted to gain an understanding of the direct effects of perceived PE autonomy-supportive instruction on a number of student outcomes. In total, 39 correlation based studies totaling 23,554 participants were analyzed with mean weighted correlation (r_w) as the analyzed effect size. Nearly all effect sizes were statistically significant ($p < .01$). Effect sizes in PE ranged in meaningfulness from large to small across the PE categories of basic needs, emotions, motivational processes and behaviors, physical activity self-esteem, physical activity motivation, and general self-esteem/concept. For LT, effect sizes were mostly medium to small across the basics needs, motivation processes, and physical activity categories. Thus, though student perceived PE teacher autonomy-support instruction was meaningfully related to basics needs, higher level motivational processes (i.e. intrinsic motivation), and positive emotions in PE and LT, the relationships were small in meaningfulness with regards to physical activity. Future research must elucidate how perceived PE teacher autonomy-support instruction may directly improve children's physical activity to combat the global inactivity epidemic.

Key words: instruction; Self-Determination Theory (SDT); quantitative review; physical education teachers.

Resumen

La inactividad física es una preocupación a nivel mundial. Los educadores físicos tienen acceso directo a los niños. Los investigadores han estudiado los beneficios percibidos en educación física (EP) por los estudiantes respecto a la formación en educación física de apoyo a la autonomía tanto en la educación física como en el tiempo libre (TL). Por ende, se realizó un meta-análisis de efecto fijo con el fin comprender los efectos directos de la percepción de formación de apoyo a la autonomía en PE en los resultados de un grupo de estudiantes. En total, se analizaron 39 estudios de correlación con un total de 23.554 participantes analizados según la correlación de medias ponderada (r_w) y el tamaño del efecto analizado. Casi todos los tamaños del efecto fueron estadísticamente significativos ($p < 0.01$). Los tamaños del efecto en PE oscilaban, de mayor a menor, a través de las categorías de necesidades básicas de educación física, las emociones, los procesos y los comportamientos de motivación, la autoestima y la motivación en la actividad física y la autoestima en general, como concepto. En LT los tamaños del efecto eran, en su mayoría, de medianos a pequeños en la categoría de necesidades básicas, procesos de motivación y actividad física. Por lo tanto, aunque la instrucción de ayuda a la autonomía del profesor de educación física fue percibida por los estudiantes como significativa en relación a las necesidades básicas, procesos motivacionales de nivel superior (es decir, la motivación intrínseca) y emociones positivas, tanto en educación física como en tiempo libre, las relaciones fueron poco significativas respecto a la actividad física. Futuras investigaciones deben aclarar cómo la percepción de la instrucción del soporte de autonomía del profesor de educación física puede mejorar directamente la actividad física de los niños, para combatir la epidemia de inactividad global.

Palabras clave: instrucción; teoría de la autodeterminación; revision cualitativa; profesores de educación física.

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Received:18 May 2015 / Accepted: 25 October 2015

Physical activity indicators for all people in developed countries are alarmingly low. For instance in the United States, only 17.7% of female and 36.6% of male high school students surveyed in 2013 indicated that they were active at least 60 minutes a day for the surveyed 7-day period (Centers for Disease Control and Prevention, 2014). In Spain, a recent survey found that only 37% of boys and 26% of girls between the ages of six and seven were engaging in at least five hours of physical activity per week (Spanish Sports Council, 2011). As discouraging as the physical activity statistics are worldwide, the obesity rates, an outcome related to physical inactivity, are even more discouraging. For instance, The World Health Organization (2010) reported that Scotland had the highest rates of obesity and overweight children with 15.1% and 31.7% being obese and overweight in Europe. Yet, children in the United States and Mexico have even *higher* percentages of obesity and overweight children (WHO, 2010). In short, children and adolescent physical inactivity and body composition are global concerns.

Certainly, even though participation in PE is not mandatory worldwide, a high quality PE program may play a very important and positive role in the promotion of healthy lifestyle habits in children and adolescents. One important aspect of PE is the teacher's instructive style that may influence student motivations for a healthy lifestyle (Hagger, Chatzisarantis, Culverhouse, & Biddle, 2003). To date, only a quantitative summary has been conducted with autonomy-supportive instruction in the health care context (Ng et al., 2012) and with adult exercise and physical activity behaviors (Teixeira, Carraça, Markland, Silva, & Ryan, 2012). Given the physical inactivity and obesity epidemics, researchers grounded in SDT have extensively investigated for the last 15 years how PE teachers motivate their students. Specifically of great interest has been the impact of students' perceptions of the degree of their teachers' autonomy-supportive instruction. Yet, again, this research has not been quantitatively summarized. Thus, the purpose of this study was to quantitatively summarize both PE and LT student outcomes correlates with perceived PE teacher autonomy-support instruction to gain an understanding of the direct impact of PE teacher's autonomy-supportive instruction.

SDT (Deci & Ryan, 2000) is a macro-theory concerned with human motivation that has been extensively investigated across many domains by researchers all over the world. In brief, SDT theory posits that all individuals have three basic and universal needs: autonomy, competence, and relatedness (Deci & Ryan, 1985, 2000). To satisfy these needs, individual effort and persistence in goal-directed behaviors are undertaken. In the end, need satisfaction impacts the full range of motivated regulations that then impact motivated thoughts, emotions, and behaviors. These needs may be altered by motivational climate or style of teaching. An autonomy-supportive teaching style is certainly one motivational style that may directly influence children's three basic needs (Deci & Ryan, 1987) as well as all motivated regulations, thoughts, emotions, and behaviors.

An autonomy-supportive teaching style is one that is characterized by teachers trying to identify, develop, and nurture children's interest a topic such as physical activity (Reeve, 2009). Autonomy-supportive teachers create students' feelings that they may initiate opportunities as opposed to the use of pressuring tactics characterized by a controlling teaching style thereby bypassing student interests (Reeve, 2009). In the PE literature, a number of paper and pencil measures have been used to tap students' perceptions of the autonomy-supportive instruction. Regardless of the measure, each attempts to measure autonomy-supportive instruction such as perceived choice, understanding, and acceptance As found in Table 1, a substantial body of literature exists that has investigated the student

physical activity based motivated outcomes with regard to perception of PE teacher autonomy-supportive instruction.

In addition to being grounded in SDT, Hagger and colleagues (Hagger et al., 2003; Hagger, Chatzisarantis, Barkoukis, & Wang, 2005) introduced the trans-contextual model into the study of perceived PE teacher autonomy-support instruction. This model incorporates the theory of planned behavior (TPB, Ajzen, 1991) to extend the potential cascade of the impact of perceived autonomy support from one's PE teacher to the LT context via motivated regulations then to the TPB constructs attitudes, perceived behavioral control, subjective norm, and intentions. Lastly, LT physical activity is measured in the trans-contextual model. Therefore, a number of student outcome variables both in PE and LT have been investigated in conjunction with perceived PE teacher autonomy support as the focus within the tenets of SDT and TPB though certainly a number of additional constructs have been measured with autonomy-supportive instruction without SDT and TPB as the guiding frameworks (Table 1).

Purpose and Hypotheses

Given the importance of combating the physical inactivity and obesity epidemics, researchers have targeted PE as a logical context to study whether teaching style may impact the eventual health of youth. To date, a quantitative review of this important literature does not exist. Though certainly PE teacher autonomy-supportive instruction framed within SDT is not hypothesized to directly impact student outcomes past the three basic needs, the relationship may be direct. In the health care context, Ng and colleagues (2012) reported in the SDT health care context small to medium effect sizes with the three basic needs and motivational processes and regulations with physical activity (Ng et al., 2012). The effect size between health care provider perceived autonomy support and physical activity was small (meta-analyzed r = .23 from 30 samples); yet, greater in magnitude than a number of SDT constructs (i.e. basics need of autonomy, autonomous regulation) that theoretically should be related more to an outcome such as physical activity. Hence, it is important to know the meaningfulness of perceived PE teacher autonomy-supportive instruction on all student motivated physical activity based outcomes is of great value to help direct future research endeavors.

Our hypotheses were very straightforward. We first hypothesized that perceived PE teacher autonomy-supportive instruction would be positively related to desirable student outcomes such as satisfying the three basic needs, intrinsic motivation, positive emotions and thoughts of self, physical activity thoughts, intentions, and behavior and negative related to undesirable student outcomes such as external regulation and negative emotions. We also hypothesized that effect sizes between perceived PE teacher autonomy-supportive instruction would be more meaningful in interpretation overall than those from LT. Last, we hypothesized that within the PE and LT contexts, the effect sizes between perceived PE teachers autonomy-supportive instruction would be more meaningful for the three basic needs and intrinsic motivation than more distal outcomes such as physical activity behavior.

Method

Search Strategy

The literature search for published studies was systematic. It included electronic databases, reviewing reference lists of three past published review articles, and search of references from retrieved articles (see Figure 1 for PRISMA diagram). The electronic database search was conducted in EBSCO with the range of individual databases specific to sport (Sport-Discus), psychology (PsychINFO, PsychARTICLES), and education (ERIC). Key word combinations

to locate published studies were based on the following terms: autonomy-supportive climate, autonomy-support, physical education, physical education teachers, physical education climate, student motivation, and Self-Determination Theory. The key word combinations were established and refined throughout the article retrieval process.

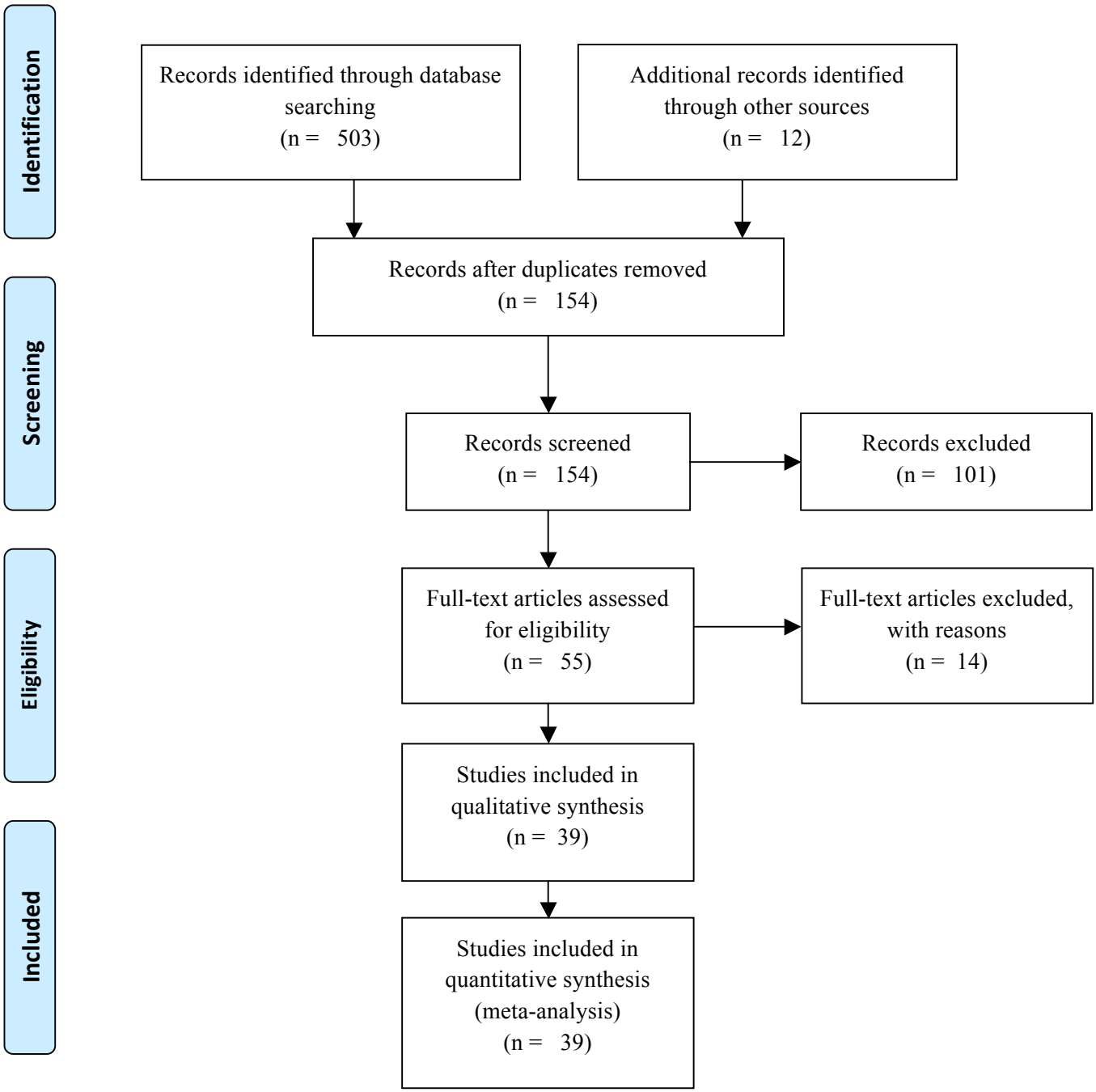

Figure 1. PRISMA flow chart

Eligibility Criteria

Articles retained for the current meta-analysis met the following inclusion criteria: (a) papers must be published in a language that the authors were fluent and if not fluent could obtain assistance from a native speaker; (b) papers must published up to the stop of the search,

March 1, 2015; (c) papers must be original data published in peer-reviewed journals, and not theses, book chapters, and or conference proceedings; (d) papers must contain a measure that was clearly in regards to perceptions of the PE teacher's autonomy-supportive climate behaviors; (e) papers must have at least one student outcome variable related to the PE teacher's autonomy-supportive behaviors; (f) papers must report sufficient statistical information such as raw correlations and sample sizes or means, standard deviations, and sample sizes; and (g) if insufficient statistical data were present, contacted authors must provide sufficient statistical information via email correspondence. The two authors with the aid of a research assistant worked diligently discussing the final set of papers meeting all eligibility criteria.

Analysis

The Comprehensive Meta-Analysis (CMA) version-2 software version 2.2.064 (July 27, 2011) was used for this meta-analysis. Based on Hedges and Olkin's (1985) suggestion, the mean weight correlation (r_w) was chosen as the measure of effect size as all extracted data were reported as correlations (see sample summary for reason for exclusion of experimental investigations). Cohen's (1977) criteria were used for interpretation of each r_w as follows: 0.10 to 0.30 as small, 0.30 to 0.50 as medium, and > 0.50 as large. Positive effect sizes should be interpreted as perceived autonomy-supportive behaviors facilitating the specific student outcome variable, whereas a negative effect size should be interpreted as the perceived autonomy-supportive instruction thwarting the specific student outcome variable.

Of the two primary models to determine statistical assumptions of error, the fixed as opposed to random model was chosen. The fixed effects model assumes that all of the gathered studies share a common effect and differences are a result of within study error or sampling error. The random effects model assumes both within study error and between-study variation. The fixed effects model was selected because *a priori* student outcome variables were separated for physical education and leisure-time, categorized into groups (e.g. motivation processes) and then reported by identical subcategories (e.g. intrinsic motivation, external regulation) when applicable. Thus, the reported effect sizes should share a common effect given the *a priori* levels of separation. Even with the *a priori* categories and subcategories, heterogeneity was analyzed. Two indicators (Q and I^2) were used to determine whether heterogeneity of variance existed. Moderators were not analyzed such as country of origin, type of autonomy-support questionnaire used as again *a priori* many distinct categories were formed. The Q test is a test of heterogeneity significance. This test is based on the critical values for a chi-square distribution. A significant Q value indicates that heterogeneity of variance exists across the individual effect sizes used to calculate the overall effect size. The Q value does not provide information on the magnitude of the individual effect size dispersion. The I^2 statistic does provide this information as it is the ratio of excess dispersion to total dispersion. As explained by Higgins and colleagues (Higgins & Thompson, 2002; Higgins, Thompson, Deeks, & Altman, 2003), I^2 may be interpreted as the overlap of confidence intervals explaining the total variance attributed to the covariates. Higgins and Thompson (2002) have provided a tentative classification of I^2 values to help interpret magnitude of the heterogeneity of variance: 25 (low), 50 (medium), and 75 (high). Last, publication bias (i.e. only reporting hypothesis supportive results or only hypothesis supporting manuscript published) is always a concern in a quantitative review. CMA provides a fail safe N statistic that is interpreted as the number of samples required to change a significant effect size into a non-significant effect size. Hence, this statistic was calculated and reported.

Table 1. Summary of included studies.

Authors, year	Autonomy-support scales	Variables	Sample size	Males	Females	Unreported	Average age	SD	Nationality
Aibar, A., Julian, J. A., Murillo, Garcia-Gonzalez, Estrada, & Bois (2015)	6-item LCQ	3b	756			756	14.32	0.73	France; Spain
Baena-Extrremera, Granero-Gallegos; Sanchez-Fuentes, & Martinez-Molina (2014)	14-item LCQ	2a, 2d, 2e, 5a, 5b	758	347	411		15.22	1.27	Spain
Barkoukis & Hagger (2009)	PASSES	2f, 8f, 9a, 9b, 9d, 9e	183	92	91		13.93	0.78	Greece
Barkoukis, Hagger, Lambropoulos, & Tsorbatzoudis (2010)	PASSES	1a, 1b, 1c, 2g, 7a, 7b, 7c, 8g, 9a, 9b, 9d, 9e	274	132	137	5	16.89	0.65	Greece
Chen, Yang, & Ji (2014)	SCQ	1a, 1b, 1c, 2a, 2b, 2c, 2d, 2e, 9a, 9b	828	425	403		17.20	1.67	China
Garn, McCaughtry, Martin, Shen & Fahlman (2012)	6-item SCQ	1a, 1b, 1c, 6a,6b	1022	490	511	21	16.13	1.31	USA
Gonzalez-Cutre, Sicilia, Beas-Jimenez, & Hagger (2014)	PASSES	1a, 1b, 1c, 2f, 7a, 7b, 7c, 8f, 9a, 9b, 9c	400	200	200		13.90	1.33	Spain
Granero-Gallegos, Baena-Extremera, Sanchez-Fuentes, & Martinez-Molina (2014)	14-item LCQ	2a, 2d, 2e, 5a, 5b, 9a	758	347	411		15.22	1.27	Spain
Haerens, Aelterman, Vansteenkiste, Soenens, & Van Petegem (2015)	TASCQ	2g, 2e	499	~218.56	~280.44		15.76	1.16	Belgium
Hagger, Chatzisarantis, Barkoukis, Wang, & Baranowski (2005)	SCQ	2f, 8f, 9a, 9b, 9d, 9e	222	104	118		14.68	1.47	UK
	SCQ	2f, 8f, 9a, 9b, 9d, 9e	93	36	57		13.99	0.80	Greece
	SCQ	2f, 8f, 9a, 9b, 9d, 9e	103	47	56		16.28	1.12	Poland
	SCQ	2f, 8f, 9a, 9b, 9d, 9e	133	66	67		13.32	0.47	Singapore
Hagger, Chatzisarantis, Culverhouse, & Biddle (2003)	SCQ	2a, 2b, 2c, 2d, 8a, 8b, 8c, 8d, 9a, 9b, 9d, 9e	295	132	163		14.50	1.35	UK
Hagger, Chatzisarantis, Hein, Pihu, Soos, & Karsai (2007)	Early version of PASSES	8a, 8b, 8c, 8d	432	198	234		13.95	1.5	UK

Hagger, Chatzisarantis, Hein, Soos, Karsai, Lintunen, & Leemans (2009)	12-item scale from *Hagger et al. (2003)*	2g, 8g, 9a, 9b, 9d, 9e	210	94	116		13.19	1.12	UK
	12-item scale from *Hagger et al. (2003)*	2g, 8g, 9a, 9b, 9d, 9e	268	117	151		15.04	0.91	Estonia
	12-item scale from *Hagger et al. (2003)*	2g, 8g, 9a, 9b, 9d, 9e	127	55	72		14.30	0.49	Finland
	12-item scale from *Hagger et al. (2003)*	2g, 8g, 9a, 9b, 9d, 9e	235	114	122		14.02	0.99	Hungary
Hein & Caune (2014)	Items presented from *Reeve & Halusic (2009)*	1a, 2f, 6b	727	288	439		~16		Latvia; Estonia
Koka (2014)	6-item SCQ	1a, 1b, 1c, 2g, 6a,6b	656	310	346		13.58	0.63	Estonia
Lim & Wang (2009)	Modified version of SCQ	2a, 2b, 2c, 2d, 2e, 9a	701	325	354	22	15.00	1.45	Singapore
Liukkonen, Watt, Barkoukis, & Jaakkola (2010)	MCPEQ	3a, 5a, 5b	338	175	163		11-12 yrs		Finland
Lodewyk & Gao (2013)	6-item LCQ	3a, 9b	513	261	252		15.25		Canada
Lodewyk & Pybus (2013)	6-item LCQ	2g, 6a, 9b	227	109	118		~16		Canada
McDavid, Cox, & Amorose (2012)	PASSES	8f, 9b	162	~65	~97		12.77		USA
Moreno-Murcia & Hernandez (2013)	ASCQ; PASSES	1a, 1b, 1c, 2a, 9a, 9b	698	331	367		14.15	1.44	Spain
Moreno-Murcia, Rojas, Gonzalez-Cutre (2008)	PASSES	1b, 2e	399	200	199		14.70	0.71	Spain
Ommundsen & Kvalø (2007)	15-item SCQ	1a, 1c, 2a, 2e, 2f, 5a, 9b	194	100	94		16.00		Norway
Pihu & Hein (2007)	SCQ	2f, 8f, 9a, 9b, 9d, 9e	626	228	398		14.90	1.30	Estonia
Rutten, Boen, & Seghers (2012)	Shortened version of TASCQ	1a, 1b, 1c, 2g	2418	1185	1233		11.03	0.51	Belgium
Shen (2015)	6-item LCQ	4a, 4b, 4c, 4d	334	177	157		15.82	1.23	USA
Shen (2014)	6-item LCQ	1a, 1b, 1c, 2f, 4d, 9b	545	305	240		14.66		USA
Shen (2010)	6-item LCQ	4d, 9e	545	305	240		14.66		USA
Shen, Li, Sun, & Rukavina (2010)	IBS	3a, 4a, 4b, 4c, 4d	566	300	266		15.01	1.32	USA
Standage, Duda, & Ntoumanis (2006)	Modified version of 6-item LCQ	1a, 1b, 1c, 2a, 2b, 2c, 2d, 2e, 2f	394	204	189	1	11.97	0.89	UK

Standage & Gillison (2007)	Modified version of 6-item LCQ	1a, 1b, 1c, 2g, 6a	300	138	162		13.51	0.77	UK
Standage, Gillison, Ntoumanis, & Treasure (2012)	6-item LCQ	1a, 1b, 1c, 2a, 2b, 2c, 2d, 2e, 6a, 6b,9c, 8a, 8b, 8c, 8d, 8e, 9b	494	201	291	2	12.58	0.74	UK
Taylor & Lonsdale (2010)	TASCQ	1a, 1b, 1c, 3a, 5a	395	142	253		14.41	0.79	China
	TASCQ	1a, 1b, 1c, 3a, 5a	320	138	151	31	14.41	0.79	UK
Trouilloud, Sarrazin, Bressoux, & Bois (2006)	LCQ	1c	421	191	230		13.42	1.73	France
Vlachopoulos (2012)	HCCQ	1a, 1b, 1c, 2a, 2b, 2c, 2d, 2e, 4a, 4b, 4c, 5a	416	219	197		13.51	0.50	USA
Vlachopoulos, Katartzi, & Kontou (2013)	HCCQ	1a, 1b, 1c, 2a, 2b, 2c, 2d, 2e, 4a, 4b, 4c, 5a	401	189	212		11.44	0.49	Greece
	HCCQ	1a, 1b, 1c, 2a, 2b, 2c, 2d, 2e, 4a, 4b, 4c, 5a	416	219	197		13.51	0.50	Greece
	HCCQ	1a, 1b, 1c, 2a, 2b, 2c, 2d, 2e, 4a, 4b, 4c, 5a	401	178	223		17.01	0.88	Greece
Yang, Chen, & Ji (2013)	SCQ	1a, 1b, 1c, 6b	1200				12.60	1.30	China
Zhang, Solmon, & Gu (2012)	HCCQ	3a	273	130	143		12.40	1.00	USA
Zhang, Solmon, Kosma, Carson, & Gu (2011)	HCCQ	1a, 1b, 1c, 2a	286	143	143		13.4	1.00	USA

Note: SD = Standard deviation; LCQ = Learning Climate Questionnaire; PASSES = Perceived Autonomy Support Scale for Exercise Settings; SCQ = Sport Climate Questionnaire; TASCQ = Teacher as Social Context Questionnaire; MCPEQ = Motivational Climate in Physical Education Questionnaire; ASCQ = Autonomy-supportive Coaching Questionnaire; IBS = Interpersonal Behavior Scale; HCCQ = Health Care Climate Questionnaire; UK = United Kingdom; USA = United States of America.

Results

Sample summary

Table 1 provides a summary of the characteristics of the sample, the autonomy-support measure used, and the contributions to student outcomes coded and found in Table 2 and 3. Given the vast difference even within the located experimental manuscripts, we decided to only analyze the correlate studies for this review[1]. A total of 39 papers were located that met the inclusion criteria with a total population size of 23,554 of which 10,954 (46.50%) were identified as females and 9,970 (42.32%) were identified as males. The approximate, as not all studies reported sufficient data, mean age of the entire population was 14.30; *SD* = 1.01 years. Of the 36 papers, 15 countries totaling 51 country specific samples were represented with the United Kingdom (*k* = 9), USA (*k* = 9), and Spain (*k* = 6) accounting for nearly half of all samples contributed to analyses. There were eight autonomy-support measures across all of the included papers. Of those, versions of the Learning Climate Questionnaire (LCQ; Williams & Deci, 1996; *k* = 10), the Sport Climate Questionnaire (SCQ; Baard, Deci, & Ryan, 2000; *k* = 8), and Perceived Autonomy Support Scale for Exercise Settings (PASSES; Hagger et al., 2007; *k* = 7) were the most used.

The two authors made a list of all measured students outcomes. From this extensive and exhaustive list, outcome variables were categorized together for analyses. The grouping into categories was straightforward. Therefore, separate analyses were set up for the following physical education student outcomes: basic needs (autonomy *k* = 20; relatedness *k* = 19; competence *k* = 20), motivation processes (intrinsic motivation *k* = 14; identified regulation *k* = 9; introjected regulation *k* = 9; external regulation *k* = 9; amotivation *k* = 22; relative autonomy index *k* = 10; autonomous regulation *k* = 10), motivated behaviors (effort *k* = 7; physical activity *k* = 3), physical activity motivation (deficient effort *k* = 7; deficient ability *k* = 7; insufficient task values *k* = 14; intentions *k* = 4), emotions (positive *k* = 11; negative *k* = 4), and self-esteem/concept (physical *k* = 6; general *k* = 4).

For leisure-time student outcomes, separate analyses were set up for the following: basic needs (autonomy *k* = 2; relatedness *k* = 2; competence *k* = 2), motivation processes (intrinsic motivation *k* = 3; identified regulation *k* = 3; introjected regulation *k* = 3; external regulation *k* = 3; amotivation *k* = 1; relative autonomy index *k* = 8; autonomous regulation *k* = 5), and physical activity (intentions *k* = 18; self-reported *k* = 18; objective *k* = 1; attitude (positive > negative *k* = 13; perceived behavioral control *k* = 13). Additional outcomes variables that did not fit the above categories existed in the two domains, physical education and leisure-time. Every effort was made to provide similar data for comparison between PE and LT as well as not present constructs with just one sample and thereby simply making a long list of constructs. A complete list of all variables found in all of the 39 included manuscripts is available from this paper's first author.

Table 2. Summary of the fixed effect sizes for correlations between perceived PE teacher autonomy-support and student PE outcome variables.

							95% CI			
Category	Code	Construct	k	N	r_w	r_w Interpretation	*LL*	*UL*	I^2	Fail safe N
Basic needs	1a	Autonomy	20	12,180	.57	Large	.55	.58	96.63	>20,000
	1b	Relatedness	19	11,661	.46	Medium	.44	.47	91.45	>12,000
	1c	Competence	20	11,874	.41	Medium	.39	.43	92.92	>10,000
Motivation processes	2a	Intrinsic motivation	14	6,998	.54	Large	.52	.55	88.12	8,528
	2b	Identified regulation	9	4,319	.50	Large	.48	.52	88.57	2,837
	2c	Introjected regulation	9	4,319	.20	Small	.17	.23	94.30	345
	2d	External regulation	9	4,319	-.15	Small	-.18	-.12	91.40	244
	2e	Amotivation	22	10,939	-.19	Small	-.21	-.18	95.15	2,672
	2f	RAI	10	3,045	.42	Medium	.39	.45	83.37	1,164
	2g	Autonomous regulation	10	5,184	.44	Medium	.42	.46	8.20	2,340
Motivated behaviors	3a	Effort	7	3,111	.33	Medium	.30	.36	89.55	646
	3b	Physical activity	3	1,527	.10	Small	.05	.15	92.66	15
Physical activity motivation	4a	Deficient effort	7	2,513	-.18	Small	-.22	-.14	72.25	128
	4b	Deficient ability	7	2,513	-.15	Small	-.19	-.11	31.61	95
	4c	Insufficient task values	14	5,026	-.26	Small	-.29	-.24	86.68	1,146
	4d	Intentions	4	1,433	.20	Small	.15	.25	90.92	46
Emotions	5a	Positive	11	4,909	.52	Large	.50	.54	81.02	4,415
	5b	Negative	4	2,180	.03		-.01	.07	98.45	0
Self	6a	Global, general	4	2,193	.22	Small	.18	.26	91.42	135
	6b	Physical	6	4,575	.32	Medium	.30	.35	98.42	652

Note: All effect sizes are statistically significant from 0 ($p < .001$) except the insignificant negative emotion effect size. k = total number of correlations included in the analysis; N = total number of participants; r_w = weighted correlation; CI = confidence interval; *LL* = lower limit; *UL* = upper limit; Z = test of null (2-tailed); I^2 = I-squared test of heterogeneity.

Effect size and fail safe N results for physical education student outcomes

Table 2 contains all of the variables meta-analyzed. Except for negative emotions, all of the effect sizes were statistically significant ($p < .01$) from 0. In addition, all of the effect sizes were calculated from total samples of at least 1,433 (sample range 1,433-12,180). For the three basic needs, the effect sizes for all needs and perceived teacher provided autonomy-support were medium (competence $r_w = .41$; relatedness $r_w = .46$) to large (autonomy $r_w = .57$) in meaningfulness. The fail safe N values were extremely large with all greater than 10,000. For the motivation processes category, the effect sizes were small (introjected regulation $r_w = .20$; external regulation $r_w = -.15$; amotivation $r_w = -.19$), medium (relative autonomy index $r_w = .42$; autonomous regulation $r_w = .44$), and large (intrinsic motivation $r_w = .54$; identified regulation $r_w = .50$) in meaningfulness. The fail safe N values ranged from 244 to 8,528. For the motivated behaviors category, the effect sizes were small (effort $r_w = .33$) and small (physical activity $r_w = .10$). The fail safe N for physical activity was only 15 while for effort it was 646. There were four constructs that were directly related to physical activity motivation. The effect sizes were small (deficient effort $r_w = -.18$; deficient ability $r_w = -.15$; intentions $r_w = .20$) to medium (insufficient task values $r_w = -.26$) in meaningfulness. The fail safe N values ranged from 46 to 1,146. The effect size for positive emotions was large ($r_w = .52$) with the fail safe N being 4,415. As stated previously, the negative emotion effect size was not significant and also inconsequential in meaningfulness ($r_w = .03$). Lastly, the effect size for physical self-esteem/concept was medium ($r_w = .32$) while general self-esteem/concept was small ($r_w = .32$). The fail safe N values were 135 and 652, for general and physical self-esteem/concept respectively.

Heterogeneity results for physical education student outcomes

Except for the very low I^2 value for autonomous regulation ($I^2 = 8.20$), and low to medium values for deficient ability ($I^2 = 31.6$) and medium I^2 value for deficient effort ($I^2 = 72.20$), the rest of the I^2 values were large (>75) suggesting that heterogeneity still exists in the data.

Table 3. Summary of the fixed effect sizes for correlations between perceived PE teacher autonomy-support and student leisure-time outcome variables.

							95% CI			
Category	Code	Construct	k	N	r_w	r_w Interpretation	*LL*	*UL*	I^2	Fail safe N
Basic needs	7a	Autonomy	2	668	.44	Medium	.38	.50	99.33	---
	7b	Relatedness	2	668	.45	Medium	.39	.51	99.51	---
	7c	Competence	2	668	.22	Small	.14	.29	96.51	---
Motivation processes	8a	Intrinsic motivation	3	1,212	.30	Medium	.31	.40	46.73	125
	8b	Identified regulation	3	1,212	.32	Medium	.27	.37	45.74	102
	8c	Introjected regulation	3	1,212	.06		.01	.12	74.54	1
	8d	External regulation	3	1,212	-.08		-.13	-.02	0.00	3
	8e	Amotivation	1	491	-.25	Small	-.33	-.17	---	---
	8f	Relative autonomy index	8	1.898	.22	Small	.17	.26	79.76	193
	8g	Autonomous regulation	5	1,099	.20	Small	.14	.26	0.00	52
Physical activity	9a	Intentions	18	6,692	.25	Small	.23	.27	78.14	1,587
	9b	Self-reported	18	5,224	.21	Small	.18	.23	70.91	650
	9c	Objective	1	491	.00		-.09	.09	---	---
	9d	Attitude (positive > negative)	13	3,130	.24	Small	.20	.27	68.82	847
	9e	Perceived behavior control	13	3,130	.15	Small	.12	.18	64.40	214

Note: all effect sizes are statistically significantly ($p < .001$) in all cases except for introjected ($p < .05$) and external ($p < .01$) regulation different than 0. k = total number of correlations included in the analysis; N = total number of participants; r_w = weighted correlation; CI = confidence interval; *LL* = lower limit; *UL* = upper limit; Z = test of null (2-tailed); I^2 = I-squared test of heterogeneity.

Effect size and fail safe N results for leisure-time student outcomes

Table 3 contains all of the variables analyzed. As previously stated, the priority was to match the LT categories and or constructs to those reported on in PE. Given the differences in the some of the research questions addressed, not all categories and constructs were matched. Except for introjected and external regulation and the one objective report of physical activity, all of the effect sizes were statistically significant ($p < .01$) from 0. Given fewer samples when compared to the physical education effect sizes, the effect sizes were calculated from smaller total samples (range 491-6,692. For the basic needs, the effect sizes for all three needs and perceived teacher provided autonomy-support were small (competence $r_w = .22$) and medium (autonomy $r_w = .44$; relatedness $r_w = .45$) in meaningfulness. Given each construct had only two samples, fail safe N values were not calculated. For the motivation processes category, the effect sizes ranged from insignificant and inconsequential (introjected regulation $r_w = .06$; external regulation $r_w = -.08$), small (amotivation $r_w = -.25$; relative autonomy index $r_w = .22$; autonomous regulation $r_w = .20$), and medium (intrinsic motivation $r_w = .30$; identified regulation $r_w = .32$) in meaningfulness. The fail safe N values ranged from 1 to 193. Lastly, for the physical activity category the effect sizes were inconsequential (objective $r_w = .00$) and small (intentions $r_w = .25$; self-reported $r_w = .21$; attitude $r_w = .24$; perceived behavioral control $r_w = .15$). The calculated fail safe N values were fairly robust (range 214-1,587) relative to the samples per each construct.

Heterogeneity results for leisure-time student outcomes

Heterogeneity varied greatly. Heterogeneity was small ($I^2 < 25$) for autonomous regulation and external regulation. Heterogeneity was medium ($I^2 < 50$) for intrinsic motivation, identified regulation, self-reported physical activity, attitude, and perceived behavior control. For the rest of the constructs, heterogeneity was high ($I^2 > 75$). Thus, unlike the physical education data, the leisure-time data had less heterogeneity.

Discussion

Ample evidence is available that strongly supports a wide range of benefits with participation in moderate-to-vigorous physical activity (MVPA) in children and adolescents. Simply put, children that participate often in MVPA are healthier than children that are inactive (U.S. Department of Health and Human Services, 2000). Unfortunately, a majority of children and adolescents worldwide are not sufficiently engaged in MVPA on a daily basis. Thus, researchers have turned to the PE environment in an attempt to motivate and engage youth in MVPA (see Lonsdale, Rosenkranz, Peraltra, Bennie, Fahey, & Lubans, 2013 for PE specific interventions). This quantitative review concerned itself with the direct relationship of PE teacher autonomy-supportive instruction on a variety of student outcomes in PE and LT.

We first hypothesized that perceived PE teacher autonomy-supportive instruction would be positively related to desirable student outcomes and negatively related to undesirable student outcomes such as external regulation and negative emotions in both the PE and LT contexts. This hypothesis was supported nearly in full. Only a few effect sizes were theoretically in the wrong direction though each was inconsequential in magnitude such as the negative emotions variable in PE. Nearly all of the effect sizes were statistically different than zero. Thus, it appears that PE teachers perceived as being autonomy-supportive have a great deal of meaningful impact on student outcomes centered on physical activity motivations and positive emotions. The two areas of caution concerned the very small effect size with physical activity behavior and the apparent heterogeneity still inherent within most of the reported effect sizes. However, the 95% CI should provide a great deal of confidence to future researchers in that the LL to UL range was typically very small in difference.

We also hypothesized that effect sizes between perceived autonomy-supportive instruction in PE would be overall more meaningful in interpretation (i.e. more large and medium effect sizes) than those from LT given the distal nature of the relationships as predicted by the trans-contextual model (Hagger et al., 2003; Hagger et al., 2005) and variants of this model (e.g. González-Cutre et al., 2014). This hypothesis was supported. More specifically, there were not any large effect sizes found within the LT results. Lastly, we hypothesized that within the PE and LT contexts, the effect sizes between perceived PE teachers autonomy-supportive instruction would be more meaningful for the three basic needs and intrinsic motivation than more distal outcomes such as physical activity behavior. This hypothesis was also supported except for the one large effect size with positive emotions in the PE context. Though certainly as has been discussed, the first line of impact is on the three basic needs.

Limitations

The main limitation of the present meta-analysis was actually the large variety of student outcomes, again a full report of all outcome variables are available from the first author, that were measured across the 39 included studies. Many of student outcome variables were measured only once. In addition though initially this body of research was focused on the trans-contextual model and grounded in SDT, a variety of research approaches have been taken; thus, increasing the number of measured student outcome variables. Thus, unlike the Ng and colleagues (2012) meta-analytic review of SDT variables and health outcomes, the present meta-analytic review had a number of approaches found within the included articles. In addition, though *a priori* it was determined that student outcomes would be categorized and like constructs grouped, a great deal of heterogeneity still existed in the report effect sizes. Though, certainly, meta-analytic research across a number of disciplines has used a variety of possible moderator variables such as country of origin, the present meta-analysis did not. Inherently, there is not a logical reason that any one country or region of the world would moderate the reported effect sizes. Nearly all of the data were published with both sexes included. Hence, sex of sample could not be examined as a moderator that may or not moderate the reported effect sizes. Last, a major limitation was the over reliance on student self-reported physical activity. In today's era with the great number of options for physical activity tracking technology, only Standage and his colleagues (2012) utilized such technology.

Future Directions and Conclusions

This meta-analytic summary provided important findings with regarding the state of perceived PE teacher autonomy-supportive instruction and student physical activity based PE and LT outcomes. Certainly, one may conclude that teacher autonomy-supportive instruction directly and very meaningfully benefits student basic needs and intrinsic motivations for physical activity. Unfortunately besides the benefits of such perceived instruction on physical activity based positive emotions, the direct impact on physical activity itself was small. To overcome this small benefit, future research must investigate how to integrate autonomy-supportive instruction with both verbalized and objectively measured physical activity goals to increase students' physical activity; more specifically up to 60 minutes of MVPA on a daily basis. Certainly, an autonomy-supportive teaching style has many benefits. But perhaps without telling the students the necessity of actually going beyond feeling motived and or feeling positive about physical activity, actual increases in physical activity may never occur. Again, Ng and colleagues (2012) meta-analysis did not provide a great deal of hope that the basic needs and or regulations have more than a small to medium positive impact on physical activity behaviors.

In conclusion, the current meta-analysis uniquely adds to the autonomy-supportive instruction literature by reporting relationships with a number of important students' motivation related physical activity constructs as well as with physical activity. Unequivocally, an autonomy-supportive instruction style is of great value, but this instructional style must be linked more meaningfully to actual engagement in physical activity or our world will continue to struggle greatly with the dire consequences of insufficiently physically active children and adolescents.

Footnote

[1]Even though meta-analysis techniques certainly allow for the combining of vastly different data sets and coded of moderators (e.g. intervention study or not), we decided to write up separate manuscripts for the correlation based data sets and the intervention data sets. The located intervention manuscripts (N = 10) are vastly different as to the length of intervention and type of autonomy-support intervention. Thus, even within those studies a number of confounding or moderating issues abound.

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