EVIDENCE-BASED ASSESSMENT IN ADAPTED PHYSICAL EDUCATION ON PSYCHOMOTOR OUTCOMES: A META-ANALYSIS

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ABSTRACT

EVIDENCE-BASED ASSESSMENT IN ADAPTED PHYSICAL EDUCATION ON PSYCHOMOTOR OUTCOMES: A META-ANALYSIS

Samuel R. Diskin

There is little data to show evidence-based practices in adapted physical education and whether it is working or not. There is a lack of information currently on the frequency that assessments are being done, on the disabilities that are being assessed or should be assessed with each test, and on the uses of the assessments that are being done. The aim of this paper is to assess and synthesize all evidence-based practices on psychomotor outcomes in adapted physical education using a meta-analysis. Data was sourced from computerized searches using the following databases: SPORT Discus, PsycINFO, PsycARTICLES, Pub Med (Medline), Cochrane Database, Omni File Full Text Mega, ProQuest, Child Development and Adolescent Studies and ERIC. Studies must have been conducted in a physical education/physical activity setting, including children between age 3-22, describe and use assessment practices or intervention in the physical education/physical activity setting, show quantitative statistics and correlations to estimate effect and be conducted between January 1970 and February 2015. The average treatment effect for all evidence-based assessments was small (g= -0.16; SE=.04; 95% C.I.= -0.24, -0.08; p<.05). Results between subgroups were not significant for any of the subgrouping variables. Overall, more studies are needed with quantitative data,

over longer periods of time, to prove any effectiveness of evidence-based assessments in adapted physical education.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

INTRODUCTION

Adapted Physical Education (APE) has been adopted and recognized as a physical education class setting in which modifications are made to ensure that students with disabilities have adequate opportunities to participate in physical activity and learning(Block, 1992). Adapted Physical Education services provide access to students with disabilities that are not being given the resources needed to improve their quality of life through physical activity(Buckanavage, Pennsylvania State Dept. of Education, & et al., 1980). Individuals with disabilities have impairments in motor function, intellectual and cognitive processing, and emotional regulation that are directly related to lower levels of physical fitness and lower participation in physical activity at all stages of life (Giagazoglou, 2013). School-based physical education can provide an environment that is ideal for individuals to receive high levels of physical activity, which oftentimes students with disabilities have a lack of opportunity or access to participate(Sit, McKenzie, Lian, & McManus, 2008). Adapted Physical Education plays a critical role in developing daily physical activity patterns as there is evidence suggesting that students with disabilities have a lack of access to physical activity and have lower levels of physical fitness in structured and unstructured settings(Aharoni, 2005). The goal of Adapted Physical Education is to have students with disabilities develop knowledge and skills that will facilitate health-related benefits to improve quality of life(Blacklock, Rhodes, & Brown, 2007; Ng et al., 2013; Speyer, Vuillemin, Herbinet, Chastagner, & Briancon, 2010) Research that has been conducted indicates that benefits are often immediate and

sustainable for children with disabilities, however, a potential limitation is that but current assessments do not evaluate learning in physical education programs as means to promote healthy and active living.

Types of Assessment in Adapted Physical Education

The types of assessment in Adapted Physical Education vary and include both objective measures of student growth as well as more subjective and observation based assessments ("Recommendations for the Fitness Assessment, Programming, and Counselling of Persons With a Disability," 1998). Assessment that is used that is more of an objective measure is usually norm-referenced testing that is a snapshot of an individual's level of functioning compared to similar group. While norms provide a reference point educational settings focus on learning and development. Students that have disabilities in physical education settings have individualized educational plans (IEP's) that provide goals and objectives to improve learning and quality of life outcomes. Tests such as the Test of Gross Motor Development (Ulrich, 2004) and the APEAS scale are used as assessments for students locomotor skills, but often times are not used frequently enough to be a basis for decisions for students or to assess over time.

Another concern is that there is a misuse of standardized tests for determining goals and objectives for individual education program objectives of students with disabilities (Block, Lieberman, & Connor-Kuntz, 1998). Teachers are using the information that they gather from standardized tests that may or may not facilitate an understanding of what can be done to improve student outcomes over time. Standardized tests may not directly inform on teaching or assessment practices that can help a student

to achieve, or to prove why a student is performing poorly in a certain area (Block et al., 1998). Assessment practices in adapted Physical Education need to be evidence-based, and the evidence needs to be used correctly to benefit all students and help them to progress.

Assessment Practices in Adapted Physical Education

Current assessment practices in APE can be described as more of teachers' preference, rather than practices that are based upon evidence. Assessment practices are based upon transition and natural environment assessments that do not include quantifiable results, and are based upon observation and subjective data. Assessments are typically norm-referenced and focused upon natural environments with observations being done at recess, lunch, field trips, etc. and are not based upon what a student can do when tested in physical education tests(Fisher & Eric Clearinghouse on Teacher Education, 1988). Students with disabilities are not usually assessed on their physical skills and advancement in physical education, with decisions usually being made about their placement through natural environment and other observations, not based upon their physical skills and what they have shown they can do objectively in physical education. The majority of assessments used in Adapted Physical Education are qualitative measures; the description of how well a student performs a task, and is used to make decisions about a student's progress or placement. Quantitative data is missing from reports of how a student is progressing, and is not used to make decisions as widely as qualitative data is used.

With the widely documented benefits of aerobic exercise, there has been only a small increase in the amount of research literature that is connected to students with disabilities and exercise(Dupper, 1990). The use of evidence-based practices and assessments can be difficult when selecting an appropriate assessment instrument to evaluate children, depending upon the disability they have(Berkeley, Zittel, Pitney, & Nichols, 2001). With such a wide variety of students' abilities and disabilities that can be present in an APE class, it can often be difficult to select evidence-based practices and assessments that can be used with an entire class of APE students.

Teaching students in Adapted Physical Education should foster learning, and assessment should inform decisions that all teachers make in their instruction. Within Adapted Physical Education, there are many practices that are used daily that have no evidence to prove the effectiveness, and no evidence to back the assessments that are used. The purpose of this meta-analysis was to identify the effect of evidence-based practices and assessments and their effectiveness in adapted physical education settings by including all intervention studies that provided quantifiable results up to August of 2015. This meta-analysis was also conducted to synthesize all studies on psychomotor outcomes of evidence-based assessments.

Statement of Problem

Assessment is a process by which teachers use evidence about student learning and performance in their decision making to facilitate meaningful change. Currently there is a lack of evidence about assessment in APE settings concerning the justification for

methods or curricula being implemented by teachers in their classrooms, that is perhaps due to a lack of understanding of the central notion of evidence-based practices (Jin & Yun, 2010). APE teachers need to use assessment to determine the needs of students with disabilities as there is a 40% prevalence of overweight and obesity(Einarsson et al., 2015) . Given these facts there is an imperative for students with disabilities to have opportunity and access to structured daily physical education that uses- evidence to support the decisions that are being made about the activities and instruction being implemented. The use of evidence-based assessments in adapted physical education are lacking information of the frequency that assessments are used, on the disabilities that are being assessed, and the uses of the data obtained from assessments. The purpose of the current investigation was to conduct meta-analytic review that evaluates assessment practices to determine the overall effect of specific student psychomotor outcomes. A secondary purpose what to evaluate the moderating effects of difference methodological, sample, and study variables.

METHODS

Search Strategies and Inclusion Criteria

A literature search was conducted in three separate phases that included a) an electronic database search, b) a search for review articles and c) a search of the reference sections in articles that were included as a part of the screening process. Electronic database searches were performed in *SPORT Discus*, *PsycINFO*, *PsycARTICLES*, *Pub Med (Medline), Cochrane Database*, *Omni File Full Text Mega*, *ProQuest, Child Development* and *Adolescent Studies*, and *ERIC* using variations of the keywords *assessment, testing, test, measurement, evaluation, formative assessment, summative assessment, norm-referenced, criterion-referenced, affective, cognitive, psychomotor, mastery learning, rubrics, testing, on-going, and standardized.* Articles retained for the current meta-analysis met the following criteria: (a) Study is conducted in Physical Education/ Physical activity setting in which inclusion of students with disabilities occurs between the age 3-22, (b) describes or uses an assessment practice, method, instrument, or intervention for students during participation in the physical education/ physical activity setting to measure progress, learning, and/or levels of functioning, (c) includes quantitative descriptive statistics and/or correlations to estimate an effect size, and (d) is in the English language and was conducted/published between January 1970 and February 2015.

Coding and Data Extraction

Coding and data extraction forms following established meta-analytic procedures were used to evaluate and code data to the relevant topic of assessment in Adapted physical education. Information was extracted from each article by three reviewers and included reviewing facts according to three subgrouping categories that included *Methodological Characteristics* 1) Assessment Approach (Formative, Summative, or Both); 2) Assessment Duration (Unit, Semester, Year, or Not Reported); 3) Assessment Setting (Inclusive or Specialized Class); 4) Assessment Focus (Motor, Cognitive, Affective, or Combination), and 5) Assessment Design (Descriptive or Experimental). *Sample Characteristics* included 6) Level of Functioning (Mild, Moderate, or Severe); 7) Environment (Physical Activity, Physical Education, or Sport); 8) Gender (Male, Female, Both); 9) School Level (Elementary, Middle, High or Combination); 10) Study Geographical location (Rural or Urban); 11) Country of Origin (US, UK, etc.); and 12) Parent Support (Parental Support OR No Parent Support). *Study Characteristics* included; 13) Study Measure (Objective or Subjective); and 14) Study Status (Published or Unpublished).

Effect Size Calculations

The Comprehensive Meta-analysis (CMA) Statistical program was employed to compute all effect sizes (BioStat, 2014). The program provided more than 258 data entry options that were used to calculate effect sizes included variations on both matched and unmatched designs across post-test, pre-post contrast and gain scores. Estimates of

effects size calculations were based on descriptive statistics such as means, standard deviations, sample sizes, and when necessary *t* or *p* values (Valentine et. al, 2003). When a study reported more than one outcome (multiple outcomes per study), the author chose the study as the unit of analysis which averages outcomes resulting in one overall calculation (Bakeman, 2005). Cohen's *d* was used as the primary measure of effect (Cohen, 1988) and interprets calculations as small ($d \geq 0.20$), moderate ($d \geq 0.50$), or large ($d \geq 0.80$).

Random Effects Model

In a fixed effects model all studies in the meta analysis are thought to share a common effect and differences in effect are a result of sampling error (within study), whereas in a random effects model it is assumed that there is both within study error and between study variance (Hedges & Vevea, 1998). A random effects model was chosen for analyses as there was expected variation between intervention methods, potential sampling error, and the possibility of random unexplained variance between studies (Hedges & Vevea, 1998). Standardized mean differences were adjusted by the inverse weight of the variance to prevent sample size from inflating study weights and allowing for a one accurate calculation of the combined effect size.

Heterogeneity of variance

When employing a random effects model there is a chance that the true effect size will vary between studies, therefore, several indicators were used to assess heterogeneity of variance. The *Q*-statistic is used as a significance test and is based on critical values

for chi-square distribution. Significant *Q* values suggest heterogeneity or that the, variability across effect sizes is greater than what would have resulted from chance (Hatala, 2005). Heterogeneous effect size distributions indicate variability that can be explained by study moderators will help provide a more accurate estimate of the distribution.

Outlier Analysis & Publication Bias

An outlier analysis was used to determine if there were any studies that influenced summary effect sizes. If outliers were present a sensitivity analysis ("one study removed" procedure) in CMA was performed by evaluating residual values (*z*-scores). The decision to include potential outliers was based on whether results would remain significant ($p < .05$) and with the 95 percent confidence interval. Publication bias was evaluated using observation of the funnel plot, Trim and Fill procedure (Duval & Tweed, 2000; 2001), and a Fail Safe *N* calculation (Rosenthal, 1981). The funnel plot provides a visual depiction of publication bias with symmetrical plots suggesting lack of publication bias and asymmetrical plots suggest publication bias (Stern, 2001). A Trim and fill procedure adjusts overall effect size by finding the number of studies it would take to provide an unbiased estimate of effect size (Duval, 2006). Fail safe N was used to determine the number of non-significant studies it would take to nullify significant results (Ivengar, 1988).

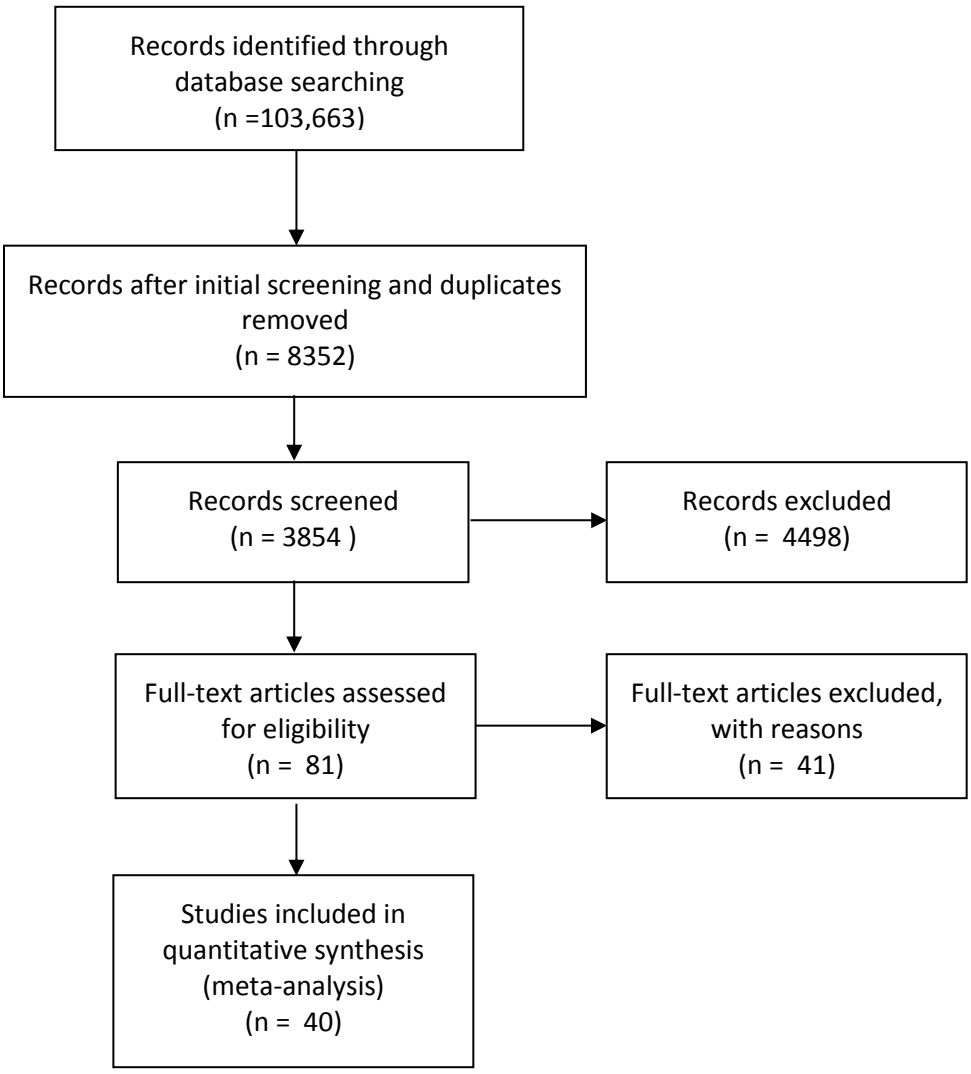

Figure 1. Selection and Screening of Articles

Tables

Table 1. Coding Characteristics for Studies meeting Inclusion Criteria

	Assessment					Participant			Study		
Study	Approach	Duration	Setting	Focus	Design	N	Level	Gender	Country	Type	Measure
Arzoglou et al 2013(Arzoglou et al., 2013)	S	U	S	M	E	10	H		Greece	P	O
Baik et al 2014(Baik, Byeun, & Baek, 2014)	S	S	S	M	E	16	M		Korea	P	O
Borremans et al 2009(Borremans, Rintala, & Kielinen, 2009)	B	S	S	M	E	20	H	B	Finland	P	C
Borremans et al 2010(Borremans, Rintala, & McCubbin, 2010)	S	U	I	Mult	E	30	H	B	Finland	P	C
Chen et al 2013(Chen et al., 2013)	S	U	S	M	E	47	E	B	Taiwan	P	C
Chrysagis et al 2009(Chrysagis, Douka, Nikopoulos, Apostolopoulou,	S	U	S	M	E	12	H	B	Greece	P	O

	Assessment				Participant				Study	
Study	Approach	Duration	Setting	Focus	Design	N	Level	Gender	Country	Type	Measure
& Koutsouki, 2009)											
Colombo-Dougovito 2013(Colombo-Dougovito, 2013)	S	U	I	M	E	51	E	B	US	P	O
Connor-Kuntz et al 1996(Connor-Kuntz & Dummer, 1996)	S	U	I	Mu	E	72	E	B	US	P	O
Davis et al 2011(Davis, Zhang, & Hodson, 2011)	S	U	S	Mult	E	25	E	B	US	P	O
Dummer et al 1996(Dummer, Haubenstricker, & Stewart, 1996)	S	U	I	M	E	77	E	B	US/Canada	P	O
Dyer 1994(Dyer, 1994)	B	Y	S	Mult	E	10	M/H	B	Australia	P	O
Favazza et al 2013(Favazza et al., 2013)	S	U	I	M	E	233	E	B	US	P	C
Fernhall et al 1998(Fernhall, Pitetti, & Vukovich, 1998)	S	U	S	M	E	34	E/M/H	B	US	P	O
Giagazoglou et al 2012(P. p. p.-s. a. g. Giagazoglou,	S	S	S	M	E	19	H		Greece	P	O

	Assessment					Participant				Study	
Study	Approach	Duration	Setting	Focus	Design	N	Level	Gender	Country	Type	Measure
Arabatzi, Dipla, Liga, & Kellis, 2012)											
Giagazoglou et al 2013(P. Giagazoglou et al., 2013)	S	U	S	M	E	18	E	B	Greece	P	O
Giagazoglou et al 2015(P. p. p.-s. a. g. Giagazoglou, Sidiropoulou, Mitsiou, Arabatzi, & Kellis, 2015)	S	S	I	M	E	200	E	B	Greece	P	O
Golubovic et al 2012("Effects of exercise on physical fitness in children with intellectual disability," 2012)	S	S	I	M	E	87	E	B	Serbia	P	O
Haibach et al 2014(Haibach, Wagner, & Lieberman, 2014)	S	U	S	M	E	100	E	B	US	P	O
Harvey et al 2007(Harvey et al., 2007)	S	U	S	M	D	44	E	B	Canada	P	C
Pan et al. 2011(Pan, Tsai, & Hsieh, 2011)	B	U	I	MULT	E	18	O	B	Taiwan	P	O

	Assessment					Participant				Study	
Study	Approach	Duration	Setting	Focus	Design	N	Level	Gender	Country	Type	Measure
Peens et al. 2004(Peens, Pienaar, & Nienaber, 2004)	S	U	I	MULT	E	58	E	B	S. Africa	P	C
Pitetti et al. 1999(Pitetti, Jongmans, & Fernhall, 1999)	B	U	O	M	E	18	O	B	US	P	O
Pitetti et al. 2004(Pitetti & Fernhall, 2004)	S	U	O	M	E	514	O	B	US	P	O
Przysucha et al.(Przysucha & Maraj, 2013)	B	U	O	M	E	20	E,O	B	Canada	P	O
Reeves 1995(Reeves, 1995)	S	U	I	M	E	60	O	B	US	P	O
Salem et al. 2012(Salem, Gropack, Coffin, & Godwin, 2012)	S	U	I,S	M	E	40	O	B	US	P	C
Screws, 1997(Screws & Surburg, 1997)	S	U	S	MULT	E	10	M	NR	US	P	O
Shapiro & Dummer 1998(Shapiro & Dummer, 1998)	S	U	S		D	50	M	M	US	P	O

	Assessment					Participant				Study	
Study	Approach	Duration	Setting	Focus	Design	N	Level	Gender	Country	Type	Measure
Shields et al. 2013(Shields et al., 2013)	S	S	S	M	E	68	H	B	Australia	P	O
Slaman et al. 2014(Slaman et al., 2014)	S	S	S	M	E	37	H	NR	Netherlands	P	O
Tarakci et al. 2013(Tarakci, Ozdincler, Tarakci, Tutuncuoglu, & Ozmen, 2013)	S	S	S	M	E	28	E/M	B	Turkey	P	O
Tsai et al. 2008(Tsai, Wilson, & Wu, 2008)	B	U	I	M	E	378	E	B	Taiwan	P	O
Tyler et al. 2014(Tyler, MacDonald, & Menear, 2014)	S	N	I	M	E	29	M/H	B	US	P	O
Valentini & Rudsill 2004(Valentini & Rudisill, 2004)	S	S	I	M	E	104	E	B	Brazil	P	O
Van Wely et al. 2014(Van Wely, Balemans, Becher, & Dallmeijer, 2014)	B	U	S	M/A	E	45	E	M	Netherlands	P	O

	Assessment					Participant				Study	
Study	Approach	Duration	Setting	Focus	Design	N	Level	Gender	Country	Type	Measure
Verderber & Payne 1987(Verderber & Payne, 1987)	S	U	S	M	D	36	E	NR	US	P	O
Verret et al. 2010(Verret, Gardiner, & Beliveau, 2010)	S	S		M/C/A	E	18	E	NR	Canada	P	C
Vujik et al. 2010(Vuijk, Hartman, Scherder, & Visscher, 2010)	S	U	S	M	E	170	E	B	Netherlands	P	O
Waelvelde et al 2004(Waelvelde, Weerdt, Cock, Smits-Engelsman, & Peersman, 2004)	S	U	I	M	E	54	E	B	Belgium	P	O
Weber & Thorpe 1992(Weber & Thorpe, 1992)	S	U	S	M	E	6	M	M	US	P	O
Wideman et al. 2009(Wideman, Baker, & Brown, 2009)	S	U	I	M	E	20	E/M/H	B	US	P	O
Willoughby et al. 2012(Willoughby, Pek, & Greenberg, 2012)	S	S	S	M	E	26	E/M/H	B	Australia	P	O

Note. Approach = Assessment Approach: F = Formative, S = Summative, B = Both Formative and Summative. Duration = Assessment Duration: U = Unit, S = Semester, and Y = Year. Setting = Assessment Setting: I = Inclusive, S = Specialized Class, O = Other. Focus = Assessment Focus: M = Motor, C = Cognitive, A = Affective, M = Multiple Foci. Design = Assessment Design: D = Descriptive, E = Experimental. Level = Participant Level: E = Elementary, M = Middle School, H = High School, O = Other. Gender = Participant Gender: M = Male Only Class, F = Female Only Class, B = Female and Male Class. Type = Study Type: P = Published, U = Unpublished. Measure = Study Measures: S = Self-Report, O = Objective, C = Combined Self-Report and Objective.

Table 2. Outcome Analyses

	Effect Size Statistics				Null Test	Heterogeneity Statistics			Publication Bias
	k	*g*	*SE*	s^2	95% C.I.	*Z*	*Q*	τ^2	I^2	Fail Safe N
Random Effects Model [a] Outcomes										
Locomotor Skills	11	0.22	0.45	0.20	(-0.663, 1.100)	0.49	505.78*	2.11	98.02	0
Object Control Skills	19	0.39	0.36	0.13	(-0.309, 1.086)	1.09	784.16*	2.23	97.71	0

Note. *k* = number of effect sizes. *g* = effect size (Hedges g). *SE* = standard error. s^2 = variance. 95% *C. I.* = confidence intervals (lower limit, upper limit). *Z* = test of null hypothesis. τ^2 = between study variance in random effects model. I^2 = total variance explained by moderator. * indicates $p < .05$. a = Total *Q*-value used to determine heterogeneity.

Table 3. Subgroup Analyses

	Effect Size Statistics					Null Test	Heterogeneity Statistics			Publication Bias
	k	*g*	*SE*	s^2	95% C.I.	*Z*	*Q*	τ^2	I^2	Fail Safe N
Random Effects Model[a]	37	-0.16	0.04	0.002	(-0.24, -0.08)	-3.82*	123.40*	0.04	70.83	330
Methodological Characteristics [b]										
Assessment Approach							5.39			
Both	7	0.069	0.410	0.168	(-0.734,0.873)	0.169		0.743	92.108	
Formative	1	0.489	1.053	1.109	(-1.575,2.554)	0.465		0.000	0.000	
Summative	32	0.173	0.038	0.038	(-0.208,0.554)	0.890		1.106	1.106	
Assessment Duration							1.36			
Unit	27	0.222	0.209	0.044	(-0.188,0.632)	1.062		1.054	95.158	
Semester	11	0.168	0.322	0.104	(-0.463,0.799)	0.522		0.880	91.819	
Year	1	-0.715	1.069	1.143	(-2.811,1.380)	-0.669		0.000	0.000	
Not Reported	1	-0.536	1.080	1.166	(-2.652,1.580)	-0.496		0.000	0.000	
Assessment Setting							3.46			
Inclusive	15	0.411	0.279	0.078	(-0.136,0.958)	1.472		1.305	96.458	
Specialized	20	-0.031	0.252	0.063	(-0.525,0.463)	-0.123		0.948	91.421	
Other	4	0.253	0.568	0.323	(-0.860,1.367)	0.446		0.000	0.000	

	Effect Size Statistics					Null Test	Heterogeneity Statistics			Publication Bias
	k	*g*	*SE*	s^2	95% C.I.	*Z*	*Q*	τ^2	I^2	Fail Safe N
Random Effects Model[a]	37	-0.16	0.04	0.002	(-0.24, -0.08)	-3.82*	123.40*	0.04	70.83	330
Methodological Characteristics[b]										
Both	1	-0.335	1.063	1.131	(-2.418,1.749)	-0.315		0.000	0.000	
Assessment Focus							2.11			
Motor	30	.409	0.193	0.037	(0.031,.787)	2.119		0.999	94.851	
Multiple	10	-0.611	0.345	0.119	(-1.286,0.064)	-1.773		0.902	90.316	
Assessment Design										
Descriptive	3	-2.336	0.595	0.354	(-3.503, -1.170)	-8.642		3.392	96.184	
Experimental	37	0.357	0.162	0.026	(0.040, 0.674)	2.208		0.767	92.950	
Sample Characteristics[b]										
Sex							1.22			
Females & Males	30	0.296	0.192	0.037	(-0.080,0.672)	1.545		0.923	94.958	
Males Only	4	-0.659	0.573	0.329	(-1.782,0.465)	-1.149		4.497	96.167	
Not reported	6	-0.065	0.464	0.215	(-0.974,0.844)	-0.139		0.296	56.489	
Age							13.75*			
Elementary	21	0.270	0.241	0.058	(-0.203,0.743)	1.118		1.080	950729	
High	5	0.413	0.514	0.264	(-0.593,1.420)	0.805		0.081	37.554	
Middle	5	-0.841	0.557	0.310	(-1.933,0.251)	-1.510		6.439	95.289	

	Effect Size Statistics					Null Test	Heterogeneity Statistics			Publication Bias
	k	*g*	*SE*	s^2	95% C.I.	*Z*	*Q*	τ^2	I^2	Fail Safe N
Random Effects Model[a]	37	-0.16	0.04	0.002	(-0.24, -0.08)	-3.82*	123.40*	0.04	70.83	330
Methodological Characteristics[b]										
Combined	5	-0.104	0.502	0.252	(-1.088,0.879)	-0.208		0.319	69.832	
Other	4	0.580	0.538	0.290	(-0.475,1.635)	1.078		1.117		
Sample Characteristics[b]										
Country							1.22			
Australia	5	0.472	0.515	0.265	(-0.538,1.481)	0.916		0.534	89.720	
Belgium	1	-0.279	1.152	1.328	(-2.537,1.980)	-0.242		0.000	0.000	
Brazil	1	0.567	1.132	1.280	(-1.651,2.785)	0.501		0.000	0.000	
Canada	3	-0.441	0.716	0.513	(-1.844,0.963)	-0.615		2.605	91.302	
Finland	1	-0.004	1.150	1.321	(-2.257,2.249)	-0.004		0.000	0.000	
Greece	4	0.360	0.628	0.395	(-0.871,1.592)	0.573		1.560	82.665	
Korea	1	0.398	1.223	1.495	(-1.998,2.749)	0.326			0.000	
Multiple	1	-0.667	1.120	1.255	(-2.863,1.528)	-0.596			0.000	
Netherlands	3	0.082	0.663	0.439	(-1.217,1.382)	0.124		0.028	28.449	
S. Africa	1	0.577	1.126	1.268	(-1.631,2.784)	0.512			0.000	

	Effect Size Statistics					Null Test	Heterogeneity Statistics			Publication Bias
	k	*g*	*SE*	s^2	95% C.I.	*Z*	*Q*	τ^2	I^2	Fail Safe N
Random Effects Model[a]	37	-0.16	0.04	0.002	(-0.24, -0.08)	-3.82*	123.40*	0.04	70.83	330
Methodological Characteristics [b]										
Serbia	1	0.270	1.133	1.285	(-1.952,2.491)	0.238		0.000	0.000	
Taiwan	2	0.095	0.811	0.658	(-1.495,1.685)	0.117		0.035	31.297	
US	16	0.150	0.297	0.088	(-0.432,0.733)	0.506		1.588	96.157	
Study Characteristics [b]							0.086			
Measure							1.195*b			
Objective	33	0.119	0.189	0.036	(-0.252,0.491)	0.630		2.512	92.066	
Combination	7	0.360	0.397	0.158	(-0.418,1.139)	0.907		0.715	97.784	

Note. *k* = number of effect sizes. *g* = effect size (Hedges g). *SE* = standard error. S2 = variance. 95% *C. I.* = confidence intervals (lower limit, upper limit). *Z* = test of null hypothesis. τ^2 = between study variance in random effects model. I^2= total variance explained by moderator. * indicates $p < .05$. a = Total *Q*-value used to determine heterogeneity. b = Between *Q*-value used to determine significance ($\alpha < 0.05$).

RESULTS

The primary purpose of the current study was to determine the overall effectiveness of evidence-based practices across all modalities of learning using psychomotor, cognitive, and affective outcomes of assessment practices for students in adapted physical education settings. The searches yielded 8352 titles of potentially relevant articles. Search procedures generated 3854 potential studies to be used in evaluation and initial decisions regarding article retrieval were based on a review of abstracts. After the abstract screening process, a total of 428 articles were identified as potential sources for data collection and retrieved for detailed analysis. After a second screening of articles, a total of 81 articles were included in the meta-analysis. There were a total of 42 studies that met the inclusion criteria for this study. These studies included independent samples comprised of 5586 children and/or adolescents. Table 1 includes all coding characteristics for studies included in the literature search that met criteria to be included in this analysis.

Outcome Analyses

Outcomes included in the current investigation were group according to locomotor and object control skills since there was no single outcome measured by more than three studies that would have permitted an accurate estimate of effect size. Object control outcomes were measured by 11 of the 40 studies and produced a small effect size ($g = 0.388$, $p > 0.05$). Outcomes measured by studies interested in object control involved a manipulative skills such as medicine ball, ball skills, bouncing, throwing, and catching.

Heterogeneity statistics produced a significant study distribution (Q =794.16, I^2 =97.71, p < .001). Studies measuring locomotor outcomes involved any movement that did not involve a manipulative. Locomotor skills measured by studies included running, jumping, skipping, and hopping. There a total of 11 studies in the analysis that produced a non-significant results (g = 0.218, p > .05). Observation of homogeneity statistics showed a significant heterogeneous distribution (Q = 505.780, I^2 = 98.023).

Moderator (Subgroup) analyses

The average treatment effect for all evidence-based assessments (across all outcomes) was small (g = -0.16; *SE* =.04; *95% C.I.*= -0.24, -0.08; p < 0.05). Table 2 presents the overview of the relevant statistics when evaluating the overall effect as there was a significant heterogeneous distribution (Q_T = 123.2, p < 0.05) and that a large portion of variance can be explained (I^2 = 70.78) by assessment approach, duration, setting, focus, and design subgroup analyses. Table Table 3 provides the subgroup analysis for methodological, sample and study characteristics.

Methodological (Assessment) characteristics

There were no significant differences between any methodological subgrouping variables, however, assessment focus and assessment design revealed differences within groups. Assessment with a motor variable focus showed a significant trend (Z = 8.64, p < 0.05) as did for experimental assessment designs (Z = 2.12, p < 0.05). Of the 40 studies reviewed, 32 were summative assessments, 1 was a formative assessment, and 7 were a combination of both formative and summative. Of these 40, 27 were a unit-long

assessment, 11 were semester long assessments, 1 was a yearlong study, and 1 was not reported. The assessments were set in a variety of settings with 15 being in an inclusive setting, 20 were in specialized classes, 1 was a combination of both inclusive and specialized, and 4 were in another setting.

Sample characteristics

There were no significant differences between any subgrouping sample variables. Studies included between 6 and 514 participants and were conducted with both male and female participants. 30 studies included both male and female, 4 were male only, and 6 were not reported. Participants were between Elementary and High school aged, with the majority being elementary school children (21 studies). Many of the included assessments were from the US (16 studies) with remaining studies conducted in Australia (5), Greece (4), Canada and the Netherlands (3), Taiwan (2) and Belgium, Brazil, Finland, Korea, South Africa, Serbia, and multiple countries with 1 study each.

Study characteristics

There were no significant differences between any study subgrouping variables. The majority of the studies that were conducted were objective measurements, with 33 being measured objectively. The other 7 studies were a combination of self-reported measurements as well as objectively measured studies.

DISCUSSION

The results of the current investigation are inconclusive as there was not a critical number of studies in the sample. The number of outcomes reported on were also limited and given the procedures used to categorize outcomes there was high degree of variability between studies. All moderators were non-significant and the heterogeneity statistics was indicated of variance that could potentially explained by moderators. There are a number of factors to be considered and future research should consider the following information when designing future studies to assess outcomes in adapted physical education settings.

Assessment Characteristics

Formative assessment was lacking severely in this meta-analysis, with most of the studies being reported as a summation at the end of the study. Formative assessment is important to be represented to help guide and shape decisions on which assessment is working, and the evidence can be used to make decisions in adapted physical education. If only summative assessments are used, there is only data that is taken after an intervention has been performed, and decisions are not informed by progress or change in what is being studied. Results from standardized assessments are often inappropriately used to develop the child's IEP for physical education. For example, IEP objectives developed directly from the Peabody Developmental Motor Scales (PDMS) (Folio &

Fewell, 1983) or the Bruininks-Oseretsky Test of Motor Proficiency (BOT) (Bruininks, 1978), two of the more popular norm-referenced tests used by APE specialists, usually have no functional relevance for the child(Block et al., 1998). Norm-referenced and summative assessments can be useful as a snapshot of students, but can be misused to inform decisions that shape a student's services and goals for physical education.

Most the studies analyzed used assessment methods that were shorter units or semester-long studies, with only one study being a yearlong assessment. Shorter units provide information on current level of functioning, however, there are limitations with shorter duration studies as the goal of education is to measure and track change over time. Longer duration studies (i.e., school year) will help to inform better decision for the long-term effects of an intervention, and can show change that a shorter assessment periods cannot. Assessment processes need to consider how learning and development change during each school year as well as track progress from throughout time at the school to inform decisions that improve student success and learning. Many the settings for assessment are in specialized classrooms, with self-contained groups of students and teachers. More information is needed on how these classrooms operate, how students interact with other groups, if their findings can only be applied because of the setting they are in or if they can be applied to the general population of students receiving adapted physical education services.

Many of the assessments that were performed were based on motor skills for students in adapted physical education. With 30 of the 40 studies being based on motor skills, there is a lack of motor skills that pertain to health-related fitness for life. Health-

related fitness is the lasting impact that physical education is designed to have on students, and with a lack of research in this field there are less answers to whether it is working or not(Hands & Larkin, 2006). As shown by (Genge & Hopper, 1990), most motor assessments are focused on actual movement skills with students walking, hopping, jumping, etc. and do not show any health-related outcomes. (Faison-Hodge & Porretta, 2004), also showed that students that receive adapted services are at a higher risk for lifelong health issues and low cardiorespiratory fitness, which reinforces the importance of health-related skills and outcomes within the population.

Sample characteristics

Gender as a moderating variable has the potential to evaluate learning and success and of the 40 studies included 30 studies involved both male and female participants, 4 that are male only, and 6 that are unreported. There are no studies researching only females, which leave a significant portion of the population out of the research. Studies that report on female specific assessments would be very beneficial to the benefits that students receive from evidence-based assessments and teaching practices. Elementary age students were in many of the studies that were presented in the meta-analysis. With research being so heavily focused on younger children, there is a lack of data on the development of many health issues that happen as children mature into teenage years and beyond. More than half of the studies were focused on elementary students (21), with middle and high school students having 5 studies each. The majority of studies show us young students and the assessments used, but taper off significantly when students get in

to high school. The need for assessments for students in adolescence and entering adulthood is huge with the implications of how they will live the rest of their lives when they are done with school and no longer receiving adapted physical education services. The majority of the assessments that were collected were performed in the United States (16) with the next highest being Australia (5) which gives us a good picture of English speaking countries. The data is lacking in areas that are non-English speaking and does not give us a well-rounded view of the population worldwide. The United States and Australia are similar in the methods that are used when working with children with disabilities, but many countries that have different methods are not represented in the data.

CONCLUSION

This meta-analysis assessed evidence-based assessments in adapted physical education with a focus on psychomotor outcomes in assessment. The overall effect size was small as well as being a heterogeneous sample. A need for more formative assessments is shown with only 1 of 40 studies being formative, and an overwhelming amount being summative assessment. The possibility of showing data over time for students would be beneficial for the adjustment and development of assessments in psychomotor outcomes. A variety of durations is also needed with the majority being a unit-long semester or a semester long. This shows a lack of assessment over time, with one being a year-long. Validity of assessments would be helped with more studies that expand into a year or longer.

Assessment settings are in mostly inclusive or specialized class settings, which is a positive and shows both ends of the spectrum of adapted physical education students. One assessment was done in a combination class setting, which could be a way to expand the settings that assessments are performed in. Measurement in the studies that were gathered was largely objective measurements, with 7 being a combination of self-report and objective measurements. Getting more self-report measurements could be a better window into the amount of physical activity and the psychomotor activities that participants are involved in outside of the classroom and the assessment setting, but also leaves the opening for skewed data being reported. Overall, more information on

evidence-based assessments in adapted physical education is needed to base decisions on facts for the benefit of students.

REFERENCES

Aharoni, H. (2005). Adapted physical activities for the intellectually challenged adolescent: Psychomotor characteristics and implications for programming and motor intervention. *International Journal of Adolescent Medicine and Health, 17*(1), 33-47.

Arzoglou, D., Tsimaras, V., Kotsikas, G., Fotiadou, E., Sidiropoulou, M., Proios, M., & Bassa, E. (2013). The effect of α tradinional dance training program on neuromuscular coordination of individuals with autism. *Journal of Physical Education & Sport, 13*(4), 563-569.

Baik, K., Byeun, J. K., & Baek, J. K. (2014). The effects of horseback riding participation on the muscle tone and range of motion for children with spastic cerebral palsy. *J Exerc Rehabil, 10*(5), 265-270. doi:10.12965/jer.140124

Berkeley, S. L., Zittel, L. L., Pitney, L. V., & Nichols, S. E. (2001). Locomotor and object control skills of children diagnosed with autism. *Adapted Physical Activity Quarterly, 18*(4), 405-416.

Blacklock, R. E., Rhodes, R. E., & Brown, S. G. (2007). Relationship between regular walking, physical activity, and health-related quality of life. *Journal of Physical Activity & Health, 4*(2), 138-152.

Block, M. E. (1992). What is appropriate physical education for students with profound disabilities? *Adapted Physical Activity Quarterly, 9*(3), 197-213.

Block, M. E., Lieberman, L. J., & Connor-Kuntz, F. (1998). Authentic Assessment in Adapted Physical Education. *Journal of Physical Education, Recreation and Dance, 69*(3), 48-55.

Borremans, E., Rintala, P., & Kielinen, M. (2009). EFFECTIVENESS OF AN EXERCISE TRAINING PROGRAM ON YOUTH WITH ASPERGER SYNDROME. / MOTORISCHE FERTIGKEITEN JUNGER ERWACHSENER MIT ASPERGER SYNDROM: EINE VERGLEICHSSTUDIE. *European Journal of Adapted Physical Activity, 2*(2), 14-25.

Borremans, E., Rintala, P., & McCubbin, J. A. (2010). Physical Fitness and Physical Activity in Adolescents with Asperger Syndrome: A Comparative Study. *Adapted Physical Activity Quarterly, 27*(4), 308-320.

Buckanavage, R., Pennsylvania State Dept. of Education, H. B. o. C. S., & et al. (1980). *Adapting Physical Education: A Guide for Individualizing Physical Education Programs*.

Chen, C. L., Kang, L. J., Hong, W. H., Chen, F. C., Chen, H. C., & Wu, C. Y. (2013). Effect of therapist-based constraint-induced therapy at home on motor control, motor performance and daily function in children with cerebral palsy: a randomized controlled study. *Clin Rehabil, 27*(3), 236-245. doi:10.1177/0269215512455652

Chrysagis, N., Douka, A., Nikopoulos, M., Apostolopoulou, F., & Koutsouki, D. (2009). Effects of an aquatic program on gross motor function of children with spastic cerebral palsy. *Biology of Exercise, 5*(2), 13-25.

Colombo-Dougovito, A. M. a. g. v. e. (2013). Comparison of Physical Fitness Performance Between Elementary-Aged Students With and Without Attention Deficit Hyperactivity Disorder. *Physical Educator, 70*(3), 262-281.

Connor-Kuntz, F. J., & Dummer, G. M. (1996). Teaching across the curriculum: Language-enriched physical education for preschool children. *Adapted Physical Activity Quarterly, 13*(3), 302-315.

Davis, K., Zhang, G., & Hodson, P. (2011). Promoting Health-Related Fitness for Elementary Students with Intellectual Disabilities through a Specifically Designed Activity Program. *Journal of Policy and Practice in Intellectual Disabilities, 8*(2), 77-84.

Dummer, G. M., Haubenstricker, J. L., & Stewart, D. A. (1996). Motor skill performances of children who are deaf. *Adapted Physical Activity Quarterly, 13*(4), 400-414.

Dupper, M. A. (1990). Effects of a 10-week aerobic exercise program on the physiological, cognitive and behavioral functioning of institutionalized retarded children *In, Vermeer, A. (ed.), Motor development, adapted physical activity and mental retardation, New York, Karger, c1990, p. 94-102.*;.

Dyer, S. M. (1994). Physiological Effects of a 13-Week Physical Fitness Program on Down Syndrome Subjects. *Pediatric Exercise Science, 6*(1), 88-100.

Effects of exercise on physical fitness in children with intellectual disability, 33, ofm 608-614, Research in Developmental Disabilities (2012).

Einarsson, I. Þ. i. h. i., ÓLafsson, Á., HinriksdÓTtir, G., JÓHannsson, E., Daly, D., & ArngrÍMsson, S. Á. (2015). Differences in Physical Activity among Youth with and without Intellectual Disability. *Medicine & Science in Sports & Exercise, 47*(2), 411-418. doi:10.1249/MSS.0000000000000412

Faison-Hodge, J., & Porretta, D. L. (2004). Physical Activity Levels of Students With Mental Retardation and Students Without Disabilities. *Adapted Physical Activity Quarterly, 21*(2), 139-152.

Favazza, P. C., Siperstein, G. N., Zeisel, S. A., Odom, S. L., Sideris, J. H., & Moskowitz, A. L. (2013). Young athletes program: Impact on motor development. *Adapted Physical Activity Quarterly, 30*(3), 235-253.

Fernhall, B., Pitetti, K. H., & Vukovich, M. D. (1998). Validation of cardiovascular fitness field tests in children with mental retardation. *American Journal On Mental Retardation, 102*(6), 602-612.

Fisher, J. M., & Eric Clearinghouse on Teacher Education, W. D. C. (1988). *Assessment Tools for Adapted and Regular Physical Education. ERIC Digest 1-88*.

Genge, G. P., & Hopper, C. (1990). Assessment in adapted physical education. *CAHPERD Journal/Times, 53*(2), 11-12.

Giagazoglou, P., Arabatzi, F., Kellis, E., Liga, M., Karra, C., & Amiridis, I. (2013). Muscle reaction function of individuals with intellectual disabilities may be improved through therapeutic use of a horse. *Res Dev Disabil, 34*(9), 2442-2448. doi:10.1016/j.ridd.2013.04.015

Giagazoglou, P. p. p.-s. a. g., Arabatzi, F., Dipla, K., Liga, M., & Kellis, E. (2012). Effect of a hippotherapy intervention program on static balance and strength in adolescents with intellectual disabilities. *Research in Developmental Disabilities, 33*(6), 2265-2270. doi:10.1016/j.ridd.2012.07.004

Giagazoglou, P. p. p.-s. a. g., Sidiropoulou, M., Mitsiou, M., Arabatzi, F., & Kellis, E. (2015). Can balance trampoline training promote motor coordination and balance performance in children with developmental coordination disorder? *Research in Developmental Disabilities, 36*, 13-19. doi:10.1016/j.ridd.2014.09.010

Haibach, P. S. p. g. c. b. e., Wagner, M. O., & Lieberman, L. J. (2014). Determinants of gross motor skill performance in children with visual impairments. *Research in Developmental Disabilities, 35*(10), 2577-2584. doi:10.1016/j.ridd.2014.05.030

Hands, B., & Larkin, D. (2006). Physical fitness differences in children with and without motor learning difficulties. *European Journal of Special Needs Education, 21*(4), 447-456. doi:10.1080/08856250600956410

Harvey, W. J., Reid, G., Grizenko, N., Mbekou, V., Ter-Stepanian, M., & Joober, R. (2007). Fundamental movement skills and children with attention-deficit hyperactivity disorder: peer comparisons and stimulant effects. *J Abnorm Child Psychol, 35*(5), 871-882. doi:10.1007/s10802-007-9140-5

Jin, J., & Yun, J. (2010). Evidence-Based Practice in Adapted Physical Education. *Journal of Physical Education, Recreation & Dance (JOPERD), 81*(4), 50-54.

Ng, A., Kennedy, P., Hutchinson, B., Ingram, A., Vondrell, S., Goodman, T., & Miller, D. (2013). Self-efficacy and health status improve after a wellness program in persons with multiple sclerosis. *Disability & Rehabilitation, 35*(12), 1039-1044.

Pan, C.-Y., Tsai, C.-L., & Hsieh, K.-W. (2011). Physical Activity Correlates for Children With Autism Spectrum Disorders in Middle School Physical Education. *Research Quarterly for Exercise & Sport, 82*(3), 491-498.

Peens, A. A., Pienaar, A. A. E., & Nienaber, A. A. W. (2004). THE EFFECT OF DIFFERENT INTERVENTION PROGRAMMES ON THE SELF-CONCEPT AND MOTOR ABILITY OF 7-9 YEAR OLD DCD CHILDREN. (Abstract) *In Klisouras, V. (ed.), 2004 PRE-OLYMPIC CONGRESS: Proceedings: VOLUME I: LECTURES-ORALS: SPORT SCIENCE THROUGH THE AGES, 6-11 AUGUST 2004, THESSALONIKI/HELLAS, ARISTOTLE UNIVERSITY CAMPUS, Thessaloniki, Greece, Aristotle University of Thessaloniki, Department of Physical Education & Sport Science, [2004], p.445-446.*;.

Pitetti, K. H., & Fernhall, B. (2004). Comparing Run Performance of Adolescents With Mental Retardation, With and Without Down Syndrome. *Adapted Physical Activity Quarterly, 21*(3), 219-228.

Pitetti, K. H., Jongmans, B., & Fernhall, B. (1999). Feasibility of a Treadmill Test for Adolescents With Multiple Disabilities. *Adapted Physical Activity Quarterly, 16*(4), 362-371.

Przysucha, E. P., & Maraj, B. K. V. (2013). Nature of Spatial Coupling in Children With and Without Developmental Coordination Disorder in Ball Catching. *Adapted Physical Activity Quarterly, 30*(3), 213-234.

Recommendations for the Fitness Assessment, Programming, and Counselling of Persons With a Disability. (1998). *Canadian Journal of Applied Physiology, 23*(2), 119.

Reeves, L. P. (1995). *Peabody Developmental Motor Scales Gross and Fine Motor Skill Performance of Young Children with Speech and Language Delays versus the National Norms*. Retrieved from http://ezproxy.humboldt.edu/login?url=http://search.ebscohost.com/login.aspx?direct=true&db=eric&AN=ED391291&site=ehost-live

Salem, Y., Gropack, S. J., Coffin, D., & Godwin, E. M. (2012). Effectiveness of a low-cost virtual reality system for children with developmental delay: a preliminary randomised single-blind controlled trial. *Physiotherapy, 98*(3), 189-195. doi:10.1016/j.physio.2012.06.003

Screws, D. P., & Surburg, P. R. (1997). Motor performance of children with mild mental disabilities after using mental imagery. *Adapted Physical Activity Quarterly, 14*(2), 119-130.

Shapiro, D. R., & Dummer, G. M. (1998). Perceived and actual basketball competence of adolescent males with mild mental retardation. *Adapted Physical Activity Quarterly, 15*(2), 179-190.

Shields, N. n. s. l. e. a., Taylor, N. F., Wee, E., Wollersheim, D., O'Shea, S. D., & Fernhall, B. (2013). A community-based strength training programme increases

muscle strength and physical activity in young people with Down syndrome: A randomised controlled trial. *Res Dev Disabil, 34*(12), 4385-4394. doi:10.1016/j.ridd.2013.09.022

Sit, C. H. P., McKenzie, T. L., Lian, J. M. G., & McManus, A. (2008). Activity levels during physical education and recess in two special schools for children with mild intellectual disabilities. *Adapted Physical Activity Quarterly, 25*(3), 247-259.

Slaman, J., Roebroeck, M., van der Slot, W., Twisk, J., Wensink, A., Stam, H., & van den Berg-Emons, R. (2014). Can a Lifestyle Intervention Improve Physical Fitness in Adolescents and Young Adults With Spastic Cerebral Palsy? A Randomized Controlled Trial. *Archives of Physical Medicine & Rehabilitation, 95*(9), 1646-1655.

Speyer, E., Vuillemin, A., Herbinet, A., Chastagner, P., & Briancon, S. (2010). Effect of adapted physical activity on health-related quality of life among hospitalized children and adolescents (the ACTIV'HOP randomized controlled trial): design and methods. *Contemp Clin Trials, 31*(2), 165-171. doi:10.1016/j.cct.2009.12.003

Tarakci, D., Ozdincler, A. R., Tarakci, E. L. A., Tutuncuoglu, F., & Ozmen, M. (2013). Wii-based Balance Therapy to Improve Balance Function of Children with Cerebral Palsy: A Pilot Study. *Journal of Physical Therapy Science, 25*(9), 1123-1127.

Tsai, C.-L., Wilson, P. H., & Wu, S. K. (2008). Role of visual–perceptual skills (non-motor) in children with developmental coordination disorder. *Human Movement Science, 27*(4), 649-664.

Tyler, K., MacDonald, M., & Menear, K. (2014). Physical activity and physical fitness of school-aged children and youth with autism spectrum disorders. *Autism Res Treat, 2014*, 312163. doi:10.1155/2014/312163

Ulrich, D. A. (2004). Test students with disabilities using TGMD. (Abstract). *Research Quarterly for Exercise & Sport, 75*(1 Suppl), A-138.

Valentini, N. C., & Rudisill, M. E. (2004). An Inclusive Mastery Climate Intervention and the Motor Skill Development of Children With and Without Disabilities. *Adapted Physical Activity Quarterly, 21*(4), 330-347.

Van Wely, L., Balemans, A. C. J., Becher, J. G., & Dallmeijer, A. J. (2014). Physical activity stimulation program for children with cerebral palsy did not improve physical activity: a randomised trial. *Journal of Physiotherapy (Elsevier), 60*(1), 40-49.

Verderber, J. M., & Payne, V. G. (1987). A comparison of the long and short forms of the Bruininks-Oseretsky Test of Motor Proficiency. *Adapted Physical Activity Quarterly, 4*(1), 51-59.

Verret, C., Gardiner, P., & Beliveau, L. (2010). Fitness Level and Gross Motor Performance of Children with Attention-Deficit Hyperactivity Disorder. *Adapted Physical Activity Quarterly, 27*(4), 337-351.

Vuijk, P. J., Hartman, E., Scherder, E., & Visscher, C. (2010). Motor performance of children with mild intellectual disability and borderline intellectual functioning. *J Intellect Disabil Res, 54*(11), 955-965. doi:10.1111/j.1365-2788.2010.01318.x

Waelvelde, H. V., Weerdt, W. D., Cock, P. D., Smits-Engelsman, B. C. M., & Peersman, W. (2004). Ball Catching Performance in Children With Developmental Coordination Disorder. *Adapted Physical Activity Quarterly, 21*(4), 348-363.

Weber, R. C., & Thorpe, J. (1992). Teaching Children with Autism through Task Variation in Physical Education. *Exceptional Children, 59*(1), 77-86.

Wideman, L., Baker, C. F., & Brown, P. K. (2009). Substrate Utilization during and after Exercise in Mild Cystic Fibrosis. *Medicine & Science in Sports & Exercise, 41*(2), 270-278. doi:10.1249/MSS.0b013e318188449b

Willoughby, M. w. u. e., Pek, J., & Greenberg, M. (2012). Parent-Reported Attention Deficit/Hyperactivity Symptomatology in Preschool-Aged Children: Factor Structure, Developmental Change, and Early Risk Factors. *Journal of Abnormal Child Psychology, 40*(8), 1301-1312. doi:10.1007/s10802-012-9641-8