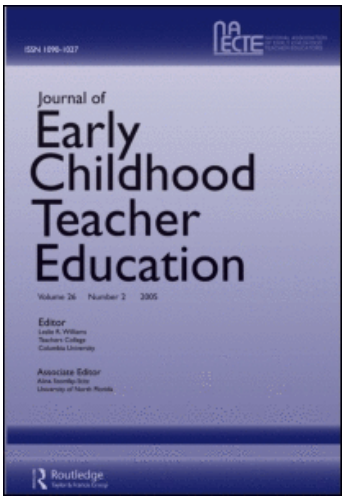

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The Influence of a Short Intervention Program on Early Childhood and Physical Education Teachers' Ability to Identify Children with Developmental Coordination Disorders

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The purpose of this study was to assess the effectiveness of a short intervention program designed to enhance the educators' ability to identify children with developmental coordination disorder (DCD). Twenty early childhood and 20 physical education teachers (n = 40) participated in the study. Participants were randomly assigned into an experimental group (n = 20) and a control group (n = 20). A 3-week intervention program implemented, which comprised of four 2-hour lectures and two practice sections of the same duration and focused on the issue of DCD within the educational setting. After the completion of the program, each educator evaluated four children's motor performance using the Movement Assessment Battery for Children Checklist (Sugden & Sugden, 1991). Subsequently, another assessment took place using the Movement Assessment Battery for Children. The total number of evaluated children was 160. Results showed that the educators who attended the educational program showed higher identification ability. No significant differences were found between physical education and early childhood teachers of the experimental group. On the contrary, in the control group, early childhood teachers exhibited higher identification ability than the physical education teachers. The intervention program significantly enhanced the educators' ability to identify children with DCD. The implication of this study is that the education of school professionals should be a continuous process.

Introduction

In school, some children face great difficulty in the execution of activities requiring motor coordination, such as writing and/or ball catching. These children do not show any known neurological problems and their difficulties are not connected to any specific pathological situation (Cratty, 1994). According to the Diagnostic and Statistical Manual-IV, the appropriate term for the condition is "Developmental Coordination Disorder" (DCD) and refers to a movement disorder that is characterized by a marked impairment in the development

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of motor coordination abilities that interferes significantly with performance of daily activities and/or academic achievement (American Psychiatric Association, 1994). Furthermore, the observed difficulties are, usually, not consistent with the child's age and intellectual ability (American Psychiatric Association). DCD manifests itself through a delay regarding developmental motor milestones (such as walking, crawling, and sitting) on the one hand, and through unwilling behaviors such as dropping of objects, poor performance in sports and poor writing ability, on the other.

Scientific data indicate that, without intervention, developmental coordination problems not only persist (Cantell, Smyth, & Ahonen, 1994; Geuze & Borger, 1993; Losse, Henderson, Elliman, Hall, Knight, & Jongmans, 1991) but can severely affect other aspects of daily living such as behavior (Gillberg & Gillberg, 1989; Losse et al.), learning and academic achievement (Henderson, May, & Umney, 1989; Lyytinen & Ahonen, 1988), self esteem and other emotional characteristics (Schoemaker & Kalverboer, 1994), as well as participation in physical activity (Causgrove-Dunn & Watkinson, 1994). Furthermore, research makes it clear that early and specific intervention can have positive outcomes (Polatajko, Mandich, Miller, & Macnab, 2001; Sugden & Chambers, 1998; Wright & Sugden, 1998). Consequently, educators' ability to identify movement difficulties among elementary school children is very important. However, it seems that early identification of DCD is controversial. While there have been studies where the educators exhibited a remarkable ability to identify and classify correctly children with DCD (Henderson & Hall, 1982; Todd, 1988), many studies have shown educators' ability to identify DCD is relatively unsuccessful (Ellinoudis, 2001; Gubbay, 1975; Junaid, Harris, Fulmer, & Carswell, 2000; Keogh, Sugden, Raynald, & Calkins, 1979; Parkkinen & Rintala, 2004; Piek & Edwards, 1997; Revie & Larkin, 1993) or close to chance (i.e., Maeland, 1992; Piek & Edwards).

Several explanations have been given by researchers to explain these discrepancies. Causgrove-Dunn and Watkinson (1996) suggest that it is quite possible the teachers' low identification of DCD is caused by their ability to recognize only the most severe cases (Maeland, 1992), and that they even overlook well-coordinated children (Ellinoudis, 2001; Junaid et al., 2000; Kourtessis, 1997; Papalexopoulou, 2003). Henderson and Hall (1982) note that children's age may be a factor that can affect the teachers' identification ability. It is possible that the nature of motor difficulties changes with age, thus making it more difficult for teachers to identify older children with DCD (Henderson & Hall), especially since older children with developmental coordination disorders manage to develop compensation strategies to hide their difficulties (Cratty, 1998).

Some researchers argue that teachers' areas of expertise can be an important factor regarding identification ability (Papalexopoulou, 2003; Parkkinen & Rintala, 2004; Piek & Edwards, 1997; Revie & Larkin, 1993); although their general identification ability remains low, physical education teachers manage to correctly identify more children with DCD than do classroom teachers (Papalexopoulou; Parkkinen & Rintala; Piek & Edwards; Revie & Larkin), and Keogh and colleagues (1979) reported that elementary teachers and early childhood teachers were unable to agree on teacher checklist ratings or on the identification of individual boys as clumsy.

In sum it seems that most teachers have little awareness and knowledge of either developmental coordination disorders or of ways to assess the extent of DCD. The main difference between studies sharing high identification rates among teachers (Henderson & Hall, 1982; Todd, 1988) and studies that demonstrate low and moderate identification rates (Ellinoudis, 2001; Gubbay, 1975; Junaid et al., 2000; Keogh et al., 1979; Maeland, 1992; Parkkinen & Rintala, 2004; Piek & Edwards, 1997; Revie & Larkin, 1993), is that,

in the former, the teachers had systematic, focused professional development regarding DCD (i.e., more than 1 hour [Parkkinen & Rintala, 2004]).

This study was undertaken to investigate the identification skills of two different types of educators, early childhood teachers and physical education teachers, within the Greek school environment. It was hypothesized that educating teachers on developmental coordination disorders issues would increase their identification ability compared to their noneducated colleagues. The Movement Assessment Battery for Children Checklist (MABCC, Henderson & Sugden, 1992) was used by the teachers to assess children. MABCC is designed to be used by teachers, parents and other professionals in order to assess functional competence in realistic everyday situations. Thus, it links assessment to intervention (Henderson & Sugden).

Method

Participants

Forty educators participated voluntarily in the study. Twenty of them were early education teachers (EET) and 20 were fourth-grade physical education teachers (PET). Participants were randomly assigned to two groups, experimental and control. Each group comprised 20 educators (10 EET and 10 PET). Following that, the experimental group attended the intervention educational program, which is described below, regarding Developmental Coordination Disorder.

Instrumentation

Movement Assessment Battery for Children (MABC, Henderson & Sugden, 1992). In this study, the MABC was used for the motor assessment of children. The specific test is a battery especially designed to assess movement difficulties that determine, at a large degree, the child's social integration mainly in school (Henderson & Sugden, 1992). MABC is a norm-referenced test that covers three major motor domains: (a) manual dexterity, (b) ball skills, and (c) static and dynamic balance. There are 32 tasks organized in four sets (8 tasks per set). Each set corresponds to one of the four age groups: Age group 1 (ages 4–6), age group 2 (ages 7–8), age group 3 (ages 9–10), and age group 4 (ages 11–12). Task characteristics are the same for each age group.

In the current study, age group 1 was used to assess kindergarten children; age group 3 was used to assess fourth-grade students. The specific tasks for age group 1 were: posting coins, threading beads and bicycle trail (manual dexterity); catching bean bag and rolling ball into goal (ball skills); one-leg balance (static balance); jumping over a cord and walking with heels raised (dynamic balance). The tasks for age group 3 were: shifting pegs by rows, threading nuts on bolt and flower trail (manual dexterity); two-handed catch and throwing a bean bag into box (ball skills); one-board balance (static balance); hopping in squares and ball balance (dynamic balance).

The child's performance on each task (seconds, steps, catches, etc.) corresponds to a respective motor score from "0" (complete success) to "5" (fail-severe movement difficulty). The scores of all eight tasks are added at the end and their sum constitutes the child's motor score. Thus, a total motor score varies from "0" for a child with no movement difficulties to "40" for a child with severe movement difficulties. This score shows the child's motor ability compared to his/her age level (note that lower scores show better performance). According to the norms that are included in the test, the differentiation criteria are

the lowest 15th and 5th percentiles. If a child has a motor score that corresponds between the 15th and 6th percentiles, he or she exhibits moderate difficulties. If his or her motor score corresponds below the 5th percentile, then the child has severe motor problems. Reliability and validity of the Movement ABC are good and are described in detail in the test's Manual (Henderson & Sugden, 1992). The specific test is being used widely in the international relative literature (Cantell et al., 1994; Chow & Henderson, 2003; Chow, Henderson, & Barnett, 2001; Dunford, Street, O'Connell, Kelly, & Sibert, 2004; Geuze & Borger, 1993; Simons & Schwarz, 2001; Sugden & Chambers, 2003; Wright & Sugden, 1996), and has been implemented in many countries worldwide, such as Sweden (Rosbland & Gard, 1998), China (Chow & Henderson, 2003), Belgium (Simons & Schwarz), Japan (Chow et al., 2001; Miyahara et al., 1998), U.K. (Smyth & Mason, 1997), Thailand (Wright, Sugden, Ng, & Tan, 1994), the Netherlands (Smits-Engelsman, Henderson, & Michels, 1998) as well as in Greece (Ellinoudis, 2007; Kourtessis, 1997; Kourtessis, Tzetzis, Kioumourtzoglou, & Mavromatis, 2000).

Movement Assessment Battery for Children Checklist (MABCC, Henderson & Sugden, 1992). MABCC is part of the MABC. It can be used in a variety of ways, either for a quick look at the child's motor capabilities, or for a long-term observation and information gathering (for a week or a month for example). Teachers, parents, and other professionals can use the MABCC in order to assess functional competence in realistic everyday situations.

The checklist, based on a theoretical analysis of movement context (Sugden & Sugden, 1991), explores the relationship between the child and the environment within which he/she is moving. The framework has four sections: (a) child stationary, environment stable (e.g., can a child stand on one leg at a stable position?); (b) child moving, environment stable (e.g., can a child walk around the classroom/school avoiding collision with stationary objects/persons?); (c) child stationary, environment changing (e.g. can a child catch a large approaching ball, bouncing or in flight, using two hands?); and (d) child moving, environment changing (e.g., can a child move around the classroom/school while avoiding collision with other moving persons?). Sugden and Sugden suggested that a child that scores poorly on all sections may experience difficulty in tasks with high kinesthetic demands, whereas a child that exhibits difficulties on sections three and four may experience problems with specific perceptual abilities, such as anticipation and/or prediction. The MABCC includes a fifth section that assesses behaviors often seen within a movement skill context. Because our focus was not on that context, the fifth section was omitted from this study.

Each of the four sections includes 12 items for a total of 48 items. For each item, the person completing the checklist is asked to note the category that best describes the child's movement. The child's performance on each item corresponds to a respective score from 0 (good) to 3 (not close; note that lower scores denote better performance). The scores of all items are added at the end and their sum constitutes the child's for each section and overall. Thus, a total motor score varies from 0 (for a child with no movement difficulties) to 144 (for a child with severe movement difficulties). This score denotes the child's motor status compared to his/her age level. According to the norms included in the MABC manual (Henderson & Sugden, 1992), the differentiation criteria are the lowest 5th and 15th percentiles according to the severity of the movement difficulties. If a child's score corresponds to the bottom 5%, can confidently be assumed to require further assessment and most of the time immediate remediative action must be employed. A score corresponding under the 15th percentile indicates a child "at risk" that should be monitored for some time in order to specify the effect of his/her difficulties on social and education and

progress (Henderson & Sugden). The profile of the child's score can also be used in a diagnostic manner to address specific concerns highlighted by the checklist (Sugden & Wright, 1998). Reliability and validity of the Movement ABC are good (Sugden & Sugden, 1991). Kourtessis et al. (2003) reported satisfactory reliability coefficients for the Movement ABC checklist within the Greek educational setting.

DCD Knowledge Questionnaire. In order to ensure that there would be no difference in the specific knowledge among the participants, a particular instrument was developed to measure knowledge on DCD. The final version of the DCD Knowledge Questionnaire consisted of 20 open and closed type questions. Five questions corresponded to each lecture. Each question had a different grading value, noted at the end of the question. The completion time for the questionnaire was 30 minutes and the maximum possible score was 100 points.

Prior to the main study, instruments' face and content validity were assessed. In particular after the selection and formation of the questions, the questionnaire was evaluated by experts (two university assistant professors with experience in the issues of DCD and childhood motor assessment) who made the essential corrections. The corrections were relevant to the content, formulation, and value of the questions. Next, the questionnaire was completed by 20 physical education teachers, who did not participate in the current study. Ten of them were rather familiar with DCD since they had attended a relative course during their graduate studies, while the remainder had no prior knowledge regarding DCD. A t-test for independent groups indicated that the differences between the two groups were significant ($t_8 = -13.01$, $p < .001$) with the expert group exhibiting higher scores. Finally, the questionnaire's reliability was tested using the test-retest method and was found to be acceptable, $t_9 = 12.14$, $p > .001$).

Intervention Educational Program. The educational program consisted of four 2-hour lectures and two practice sections of the same duration and it was completed within 3 weeks. The program provided knowledge about definition, aetiology, characteristics, identification, assessment and intervention of DCD. More specifically, the four lectures included: (a) Definition and possible factors accountable for the existence of motor difficulties; the effectiveness of intervention; (b) Clumsy children: motor, psychological and educational characteristics and the role of the family and social environment on the development of these characteristics; (c) Identification and evaluation of the motor difficulties; the educator's ability to use motor tests; the use of MABC; (d) Basic motor abilities: the importance of knowledge regarding their development within the evaluation process. The context of practical training included the demonstration of the examined dexterities of the 1st and 3rd age-related categories of the MABC. Each lecture was accompanied by corresponding written notes.

Procedures

Initially, all participants filled out the DCD Knowledge Questionnaire. The aim of the questionnaire was to detect any possible differences between groups regarding their knowledge on DCD. Following that, the members of the experimental group attended the educational program. After the completion of the educational program all participants were asked to indicate four children (two boys and two girls) from their class who were suspected for movement difficulties. When educators reported that there were no such cases, children were drawn randomly from the nominal list of each class. During this

Table 1
Descriptive Data of the Children and Classification According to Their MABC Scores

			MABC		
Age group	N (b/g)	Age in months (M/SD)	>15% (N/%)	<15% (N/%)	<5% (N/%)
Kindergarten	80 (40/40)	63.44 (7.82)	64 (80%)	11 (13.75%)	5 (6.25%)
fourth grade	80 (41/39)	115.88 (5.19)	54 (67.5%)	13 (16.25%)	13 (16.25%)
Total	160 (81/79)		118 (73.75%)	24 (15%)	18 (11.25%)

process, the names of children who according to their educators' opinion were very agile during physical activities were excluded. Thus, a pool of 160 children was formed (81 boys and 79 girls). Eighty of them were kindergarten students (mean age 63.44 months, *SD* = 7.82) and 80 were fourth graders (mean age 115.88 months, *SD* = 5.19). The children's classification according to their MABC scores as well as their descriptive data are cited in Table 1.

Shortly afterwards and after a 7-day observation period, the participants evaluated the children's motor ability by completing the MABCC for each selected child of their class. During this process, all the children's motor ability was assessed by the experimenters using the MABC, in order to find out their actual total motor score. Thus the MABC motor score was served as the criterion test to decide on whether developmental coordination disorder problems existed among the examined children. The participants had no knowledge of the MABC scores nor did the experimenters of the educators' evaluation through MABCC.

Results

DCD Knowledge Questionnaire

One way ANOVA revealed that there were no significant differences regarding knowledge about Developmental Coordination Disorders between early childhood and physical education teachers of the two groups ($F_{(3,36)} = .58$, $p > .05$).

Educators' Identification Ability

The results revealed that the educators of the experimental group classified correctly 71 (88.7%) out of the 80 assessed children while the participants of the control group classified correctly 29 children (36.2%) out of 80 (Table 2). Comparison of the frequencies revealed statistically significant differences [χ^2 (1, N = 80) = 47.04, $p < .001$, Cramer's $V = .52$]. Thus, educators who received additional training showed better ability to classify the children correctly, according to the movement difficulties, than their untrained colleagues.

Next, the same analysis was performed separately for early childhood teachers and physical education teachers across the two experimental conditions. Overall, four comparisons of correct classification frequencies were conducted. In order to control for type I error the level of statistical significance was adjusted according to the Bonferroni inequality (Myers & Well, 1991). Thus, the new level of significance was set at .0125 (.05/4).

Table 2
Correct Identification Percentages Across the Experimental and Control Group for the Two Categories of Educators

	P.E. teachers	Kindergarten teachers	Total
Experimental	92.5% (37 out of 40)	85% (34 out of 40)	88.7% (71 out of 80)
Control	17.5% (7 out of 40)	55% (22 out of 40)	36.2% (29 out of 80)

Results revealed that trained physical education teachers were more accurate in classification than their untrained colleagues [χ^2 (1, N = 80) = 45.45, p < .001, Cramer's V = .75]. Similarly, trained early childhood teachers outperformed their untrained colleagues in their ability for correct classification [χ^2 (1, N = 80) = 8.57, p = .003, Cramer's V = .33].

Finally, chi-square analysis did not reveal any differences regarding correct-classification frequencies between early childhood and physical education teachers of the experimental group [χ^2 (1, N = 80) = 1.13, p = .288]. On the contrary, early childhood teachers in the control group demonstrated better skill at classifying children than PE teachers [χ^2 (1, N = 80) = 12.17, p < .001, Cramer's V = .39].

Discussion

The purpose of the current study was to investigate the effect of further education and training on the ability of early childhood and physical education teachers to identify and classify children according to the presence of developmental coordination difficulties. Therefore, the first step was to explore the identification skills of the above professionals. The results from most of the few related studies revealed rather low and/or moderate correct identification rates, suggesting a weakness of school professionals to contribute successfully to the process of early assessment and intervention at a time that seems so important for children with developmental coordination disorders (Ellinoudis, 2001; Gubbay, 1975; Junaid et al., 2000; Keogh et al., 1979; Maeland, 1992; Parkkinen & Rintala, 2004; Piek & Edwards, 1997; Revie & Larkin, 1993). Revie and Larkin stressed the fact that educators lack theoretical and practical knowledge regarding motor growth as well as the ability to observe movement.

In the current study the uneducated and uninformed early childhood and physical education teachers of the control group failed to correctly identify and classify more than 29 out of 80 assessed children (36.2%). Given the fact that some children would be identified by both types of educators, the above percentage might be even lower. This outcome comes in total agreement with prior research. It is interesting to note that, within control group, early childhood teachers had significantly better ability in classifying children (55%) than physical education teachers (17.5%). This comes in contrast to previous research (Papalexopoulou, 2003; Parkkinen & Rintala, 2004; Piek & Edwards, 1997; Revie & Larkin, 1993), where specialists of physical education exhibited better performances. Based on the above results, the researchers stressed that classroom as well as early childhood teachers are not well acquainted with the basic locomotor and manipulative skills. Therefore physical educators are in a better position regarding identification process (Parkkinen & Rintala; Piek & Edwards; Revie & Larkin). An explanation for

the above controversy could be the fact that within the Greek educational system, physical education is taught once or twice a week. Thus there is serious time limitation regarding the opportunity for the physical education specialist to observe, assess carefully, and consequently classify without any doubt the children according to the presence or not of movement difficulties. On the other hand, early childhood teachers spend much more time with the children on a daily basis by playing various games that require movement and thus are more able to identify possible coordination problems.

The second equally important goal of this research was to investigate the effect of further education and training on the ability of the participating professionals to identify and classify children based on the presence or not of developmental coordination difficulties. According to the results, the effect of the intervention was impressive. The participants of the experimental group classified correctly 71 (88.7%) out of the 80 assessed children showing significantly higher ability to identify and classify children correctly, according to the movement difficulties, than their untrained colleagues. This comes in total agreement with Henderson & Hall (1982) and Todd (1988), whose research demonstrates the value of informing and training school professionals before engaging them in the identification and assessment process.

In keeping with prior research, our results revealed that trained physical education teachers were more accurate than their untrained colleagues and similarly, trained early childhood teachers outperformed their untrained colleagues. Finally, the analysis did not reveal any differences regarding correct-identification frequencies between early childhood and physical education teachers of the experimental group. This may lead to the notion that a well-structured seminar could reverse any lack in movement-related knowledge that classroom or kindergarten teachers may have, thus giving the opportunity to every school professional to participate in the screening and/or identification process.

This study has important implications for teacher education. There is no doubt that early and accurate identification of children with DCD may increase the positive outcomes of any intervention program (Polatajko et al., 2001; Sugden & Chambers, 1998; Wright & Sugden, 1998). The finding that educators' ability to identify children with and without movement difficulties is rather low unless they receive specific education and practice should be taken into consideration by policy makers and university administrators. If educators are expected to effectively identify children with DCD, then specific training should be provided to prospective teachers as well as to in-service teachers. It has been suggested that educators' training could be more effective if it combined theoretical knowledge with the development of necessary competencies and experiences. (Durodoye, 1998; Lim & A' Ole-Boune, 2005; Theodorakis, Bagiatis, & Goudas, 1995; Tsigilis, Tsioumis, & Gregoriadis, 2006).

Conclusively, the results of the present study support previous relative findings regarding the general low to moderate ability of untrained school professionals to correctly identify children with developmental coordination disorders. Furthermore, current findings agree to previous ones and thus strengthen the fact that well-informed and trained educators can be very effective in identifying and classifying children with movement difficulties. Early childhood and physical education teachers benefited equally from the training program outperforming their untrained colleagues. The need for further research on topics related to teacher education and training, identification, and assessment procedures seems warranted.

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