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PHYSICAL FITNESS CLASSIFICATION STANDARDS FOR POLISH EARLY EDUCATION TEACHERS

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ABSTRACT

This study determined the general fitness level of female early education teachers (EETs) (N=217) based on fitness test standards, and compared the results with those of preschool children (N=700), early elementary school children (n=1306) and female early education university students (FEEUSs) (N=303) in Poland. All participants were subjected to height and weight measurements and their BMI scores were determined. Based on eight motor fitness tests, the general physical fitness level of EETs was 'average', based on the classification standards in Podstawski's Test. The scores of the EETs were 'poor' in three motor tests, 'average' in four tests and 'good' in only one test. The EETs scores were significantly poorer than early elementary school children in 4x10m shuttle run, sit-ups in 30s, bent arm hang on bar and a 1-minute Burpee test. The results of the EETs were significantly below those of FEEUSs in the standing long jump, 4x10m shuttle run, sit-ups in 30s, medicine ball backward throw and downward bend from astanding position. Physical fitness plays a very important role in the daily work of EETs. Recruitment principles for early education programmes should be revised to include fitness tests and early education curricula should be expanded to include physical education classes.

Key words: Early education teachers (EETs); Female university students; Six- to nine-year-olds; General physical fitness; Classification standards.

INTRODUCTION

Physical fitness is one of the key indicators of biological and motor development, as well as human health. The concept of physical fitness has been researched extensively in physical education and exercise science. Health-Related Fitness (H-RF) has recently emerged as the most effective approach to achieving the optimal quality of life. According to the H-RF concept, a physically fit person should be characterised by high levels of cardio-respiratory endurance, vigour, positive relations with other people, healthy body fat levels, high levels of

muscular strength and flexibility and a healthy lower back (lumbo-sacral region of the spine) (Howley & Franks, 1997).

Although the definition of and assessment criteria for physical fitness have been revised in the past two decades (Szopa *et al.*, 1998; Raczek, 2010), physical fitness tests are still very important in evaluating motor skills development in children (Bénéfice & Ndiaye, 2005; Tudor *et al.*, 2009; Podstawski & Borysławski, 2012), adolescents (Tomkinson, 2007; Houtari *et al.*, 2009), and their contribution to sport training (Mikulić & Ružic, 2008; Gabbett, 2009).

Most research studies investigate general fitness levels at various stages of ontogenetic development and the influence of physical activity on fitness levels (Pangrazi *et al*., 1996; Prista *et al.*, 1997; Boreham & Riddoch, 2001; Corbin, 2002; Podstawski, 2006; Kovac *et al.*, 2012). Longitudinal studies (Hands, 2008; Bürgi *et al*., 2011) and cross-sectional studies (Yagi *et al.*, 1989; Claessens & Lefevre, 1992; Tomkinson, 2007), conducted on various populations and over different time periods (a decade) contribute very valuable data. A steady increase in the incidence and prevalence of lifestyle diseases and a progressive decrease in physical activity levels contribute to the relevance of these research studies. In some cases, research findings are the only diagnostic tool for health forecasting in selected human populations (Wolański *et al.*, 1992).

Fitness evaluations are performed in various populations, and physical fitness is analysed based on different criteria. The only occupational group whose fitness level was investigated to a limited degree are physical education teachers (PETs) and early education teachers (EETs) who are nearly completely responsible for physical education in Polish kindergartens and elementary schools. This deficiency stands in contradiction to the very nature and purpose of physical educators' work. PETs and EETs can instil a positive attitude towards the body and physical activity in children and adolescents, thus motivating students to become more physically active. Teachers need extensive theoretical knowledge and years of practical experience to promote physical fitness effectively among preschool children and early elementary school students (Graham *et al.*, 2004; Mitchell *et al*, 2006). According to the National Standards for Physical Education, which have been created by the Michigan Department of Education (2004) and the National Association for Sport and Physical Education (2008), a physically educated person should:

- demonstrate competency in motor skills and movement patterns needed to perform a variety of physical activities;
- demonstrate understanding of movement concepts, principles, strategies and tactics as they apply to the learning and performance of physical activities;
- participate regularly in lifelong physical activity;
- achieve and maintain a health-enhancing level of physical fitness;
- exhibit responsible personal and social behaviour that respects self and others in physical activity settings; and
- value physical activity for health, enjoyment, challenge, self-expression, and/or social interaction.

Above all, a physical education (PE) teacher should demonstrate a high level of physical fitness because in preschool and early elementary schoolchildren, the attitudes towards sport and physical activity are shaped through visual rather than verbal stimuli (Melville, 1999; Cardinal, 2001). In PE classes, children learn new movements by imitating the teacher whose movements should be smooth and harmonised and who should perform the demonstrated physical activities with ease (Ziegler, 2003). Children develop locomotor (movement with change of position), non-locomotor (movement without change of position), and manipulative (object handling) skills in preschool age (Hraski *et al*., 2011). Preschool children develop awareness that physical activity affects their bodies, deliver health benefits, improve social opportunities and contributes to the quality of life (Ziegler, 2003; Castelli & Williams, 2007).

The PE teacher (Manross & Templeton, 1997) should instil this knowledge in their students. Physical education teachers, who have poor motor skills and are overweight/obese, evoke a negative response in students and are not considered role models for PE (Melville & Maddalozzo, 1988; Melville & Cardinal, 1997). This theory was confirmed by Archibald *et al*. (2009) who examined pre-service teachers' game performance competencies in soccer, basketball and volleyball, and observed that highly skilled teacher candidates demonstrated more effective teaching practices than lower skilled candidates.

There are no studies comparing the physical fitness levels of PETs and EETs with those of schoolchildren and adolescents. The fitness levels of both teacher groups have been rarely investigated, but the correlations between PETs' qualifications and performance during PE classes have been analysed by a number of studies. According to applicants planning to study PE, a PE teacher should be characterised by a love of sport and physical activity (Dodds *et al.*, 1992; Smith, 1993). He/she should demonstrate an adequate level of physical fitness and serve as a role model for the students (Melville & Cardinal, 1997; Pagnano & Langley, 2001).

Physical education teachers that have low motor skills and game performance skills could have a negative impact on PE programmes, and they are unlikely to promote the development of physically educated individuals. PETs that lack the required skills and fitness will not provide their students with adequate demonstrations, accurate analysis or comprehensive feedback. In the worst-case scenario, those educators may not teach such content at all. PETs' motor skills and fitness levels lend credibility to their content knowledge. Research indicates that PETs' motor skill competence plays a key role in developing children's physical fitness levels into adulthood (Stodden *et al.*, 2009). Physically fit children often want to test their skills by competing with the teacher. They encourage PETs to demonstrate their motor skills and are strict critics of the teacher's performance (Ferrari, 1996; McAlister *et al*., 2008). This process brings to mind the ‘master and pupil’ relationship.

MOTIVATION FOR STUDY

An evaluation of the physical fitness level of EETs and its comparison with those of preschool children, early elementary schoolchildren and female early education university students (FEEUSs) would provide highly interesting and valuable insights. These findings could be applied to reverse the progressive decrease in physical activity among children (Ara

et al., 2007) and adolescents (Powell *et al.*, 2006). The results could also contribute to the development of new physical fitness standards for EETs.

PURPOSE OF RESEARCH

The objective of this study was to evaluate the level of general physical fitness in female EETs based on fitness test standards, and to compare the results with those achieved by preschool children (6-year-olds), early elementary school students (7- to 9-year-olds) and FEEUSs (19- to 20-year-olds) from the University of Warmia and Mazury in Olsztyn, Poland.

METHODOLOGY

Participants

Physical fitness tests were conducted with 12 kindergarten groups and 14 elementary school groups and among first-year, full-time EEFUSs from the University of Warmia and Mazury in Olsztyn (UWM). EETs participated in fitness evaluations at the workplace (40 kindergarten and 50 elementary school teachers). Tests were conducted in kindergarten classes and schools in rural areas, small towns, medium-sized towns and big cities in the Region of Warmia and Mazury to ensure that the participants' socio-economic status was broadly represented. The study was performed in the Region of Warmia and Mazury in north-eastern Poland (Figure 1).

FIGURE 1. **REGION OF WARMIA AND MAZURY IN POLAND**

The participants were 700 kindergarten pupils (Girls=367; Boys=333) with a mean age of 5.80 years, 1306 early elementary school pupils with a mean age of 7.99 years (Grade 1: 225 girls & 201 boys; Grade 2: 219 girls & 213 boys; Grade 3: 233 girls & 215 boys), 303 first-year full-time female students of the UWM with a mean age of 19.01 years and 217 certified and professionally active EETs with a mean age of 26.24 years.

A total of 96% pupils from the evaluated kindergartens and elementary schools participated in the fitness tests. Only pupils who were absent on the day of the evaluation were not included in the study. Early education teachers that were excused from PE classes for medical reasons or were not willing to participate in the study did not perform the fitness tests. Of the group of 721 EETs who were invited to participate in the study, 167 were medically certified or had permanent damage to locomotor organs and 337 women refused to participate without stating a reason and thus did not partake in the testing.

The study involved preschool children and early elementary school pupils attending obligatory PE classes (three 45-minute classes per week) who did not perform any additional forms of physical activity. Students involved in extracurricular physical activities were not chosen for the study because their performance could significantly skew the results. Early education students of the UWM attended obligatory PE classes at university (two 45-minute classes per week). The analysed population was large, therefore, the obtained data can be regarded as representative of the focus groups.

Ethical clearance

The Bioethics Committee of the University of Warmia and Mazury in Olsztyn approved the study, which did not violate the principles of the analysed kindergartens and schools, or affect the safety of the evaluated students and teachers. The study was conducted according to the WMA (World Medical Association) Declaration of Helsinki.

Measurement instruments

The participants were subjected to *height* and *weight* measurements, and the results were used to calculate their BMI. The BMI scores of adults were evaluated based on WHO guidelines (WHO, 2000), and the scores of preschool and early elementary school pupils were processed in accordance with the international standards developed by Cole *et al*. (2007). The results obtained by the participants in individual motor competence tests constituted dependent variables.

Motor abilities were evaluated in eight motor competence tests: *standing long jump* (cm), *4x10m shuttle runs* (sec.), *skipping with hand clapping* in 8sec. (number of claps), *sit-ups in 30sec.* (number of sit-ups), *medicine ball* (2kg & 4kg) *backward throw* (cm), *bent arm hang* on bar (sec.), *downward bend from standing position* (cm), and *1-minute Burpee test* (number of cycles). The accuracy and reliability of each motor test has been confirmed by numerous studies (Pilicz, 1997; Szopa *et al.*, 1998).

All motor skill tests were conducted in the gym facilities of kindergartens, elementary schools and the UWM to ensure that all participants were tested in similar conditions. Children from two kindergartens were tested in the gyms of nearby elementary schools that also participated in the study. Motor skill tests were administered by all co-authors who were assisted by female EETs responsible for the evaluated groups of preschool children and elementary school pupils.

The tests were always administered in the same order, starting with the coordination tests, through agility, speed, flexibility and strength tests, and ending in strength-endurance tests.

The physical fitness level of EETs was evaluated based on the classification standards of Podstawski's Test (5-point grading scale: unsatisfactory, poor, average, good, very good), and score tables developed for a T-scale (Podstawski, 2006). The tables were used to score every fitness test separately. The classification standards of Podstawski's Test were developed based on the results of female university students who, similar to EETs, were residents of the Region of Warmia and Mazury.

Both the pupils and EETs were also classified in the same developmental stage. Every participant was instructed on the proper technique of executing the given motor tasks during lessons preceding the actual tests and were given time to practise them. The project manager, who demonstrated the proper technique of performing each exercise, instructed the EETs and they were allowed to practise on their own. The participants took part in a 10-minute warm-up routine before the testing commenced. The warm-up routine was identical for all groups, and it comprised selected physical exercises and movement patterns, including jogging, wrist, elbow and arm circles, leg swings, jumps, balance exercises, front hold exercises, two 20-meter dashes, dynamic stretching and corrective drills (Frandkin *et al.*, 2010). The study was conducted in March, in the summer of the 2011/2012 academic year.

Statistical analysis

The results were processed in the Statistica PL v. 10 application using the descriptive statistics module and the Mann-Whitney U-test for two independent samples at the significance level of α=0.05. When the probability that the calculated value would be exceeded was smaller than the adopted significance level ($p<0.05$), the differences between the analysed groups for a given fitness test were regarded as significant.

RESULTS

The participants' height, weight and BMI scores are presented in Table 1. Fitness test scores based on the classification standards of Podstawski's Test are given in Table 2. The differences in test scores between groups are presented in Tables 3 and 4. In line with the research objective, the description of results focused on analysing EETs' scores and comparing them with the performance of the other groups.

The results presented in Table 1 indicate that EETs' *weight, height* and *BMI* scores were significantly higher than the values reported for preschool children, early elementary school students and first-year female university students. EETs' average BMI scores (25.16 kg/m^2) placed them in the overweight category.

Based on the classification standards of Podstawski's Test (Podstawski, 2006) (Table 2), EETs received ‘poor’ scores in 3 motor tests (standing long jump, sit-ups in 30sec., 1-minute Burpee test), ‘average’ scores in 4 tests (skipping with hand clapping, bent arm hang on bar, medicine ball backward throw, downward bend from standing position), and a ‘good’ score in only 1 test (4x10m shuttle run). Their average overall score was 373 points, which is indicative of an average level of physical fitness (330-460 points) (Podstawski, 2006:54).

TABLE 1. **BODY HEIGHT, BODY WEIGHT AND BMI SCORES**

Participant groups	N	Mean±SD (min–max) Age (years)	Weight (kg)	Height (cm)	BMI (kg/m^2)
a. Preschool girls	367	5.79±0.405 (5.07–6.06)	18.82±1.988 (15.00–26.00)	117±3.692 (107–126)	13.64±1.182 (11.91–18.90)
b. Preschool boys	333	5.81±0.394 (5.07–6.06)	22.67±2.260 (17.40–9.00)	119±4.174 (112–128)	15.99±1.378 (12.98–20.48)
c. Grade 1 girls	225	6.99±0.120 (6.00–7.00)	24.76±5.327 (18.00–41.00)	124±7.727 (111–152)	16.12±2.387 (11.48–24.96)
d. Grade 1 boys	201	6.97±0.192 (6.00–8.00)	27.20±6.038 (18.00–50.90)	126±7.569 (111–152)	17.11±2.701 (13.01–30.59)
e. Grade 2 girls	219	7.98±0.193 (7.00–9.00)	28.33±6.200 (20.00–53.00)	131±5.921 (118–147)	16.48±2.653 (11.39–24.78)
f. Grade 2 boys	213	7.99 ± 0.200 (7.00–9.00)	30.30±7.010 (18.70–52.00)	134±5.935 (113–152)	16.82±3.271 (11.35–30.59)
g. Grade 3 girls	233	9.00±0.188 (8.00–10.00)	31.56±5.451 (22.00–52.10)	135±6.044 (122–155)	17.24±2.385 (12.72–29.27)
h. Grade 3 boys	215	9.02±0.187 (8.00–10.00)	34.10±7.031 (20.10–59.60)	137±6.176 (116–155)	18.14±2.856 (13.40–25.08)
i. 1st yr fem. students	303	19.01±0.244 (18.00–20.00)	61.33 ± 6.501 (49.20–89.50)	160±8.130 (146–183)	24.18±3.575 (17.30–39.78)
j. EETs female	217	26.24±1.679 (23.00–31.00)	68.22±9.330 (49.00–101.00)	164±7.654 (149–192)	25.16±2.465 (19.14–32.81)
Significance (Mann-Whitney U-test):		– for body weight: j > a, b, c, d, e, f, g, h, i, ** – for body height: j > a, b, c, d, e, f, g, h, i, ** – for BMI: j > a, b, c, d, e, f, g, h, i, **			

* p<0.05 ** p<0.01

TABLE 2. **GENERAL PHYSICAL FITNESS OF EETs**

Motor test	EETs' Mean±SD (min-max)	Podstawski Score
Standing long jump (cm)	134.90±11.26 (91–171)	32 (poor)
4 x 10 m shuttle run (sec.)	13.68±0.76 (11.78–16.07)	67 (good)
Skipping with clapping in 8 sec. (No. of claps)	24.11±2.91 (11–33)	57 (average)
Sit-ups in 30sec. (No. of sit-ups)	14.78±4.08 (0–25)	36 (poor)
Bent arm hang on bar (sec.)	5.36±3.60 (0–18.91)	44 (average)
Medicine ball (4 kg) backward throw (cm)	633.69±84.42 (320–890)	51 (average)
1-minute Burpee test (No. of cycles)	17.90±3.36 (9–25)	39 (poor)
Downward bend from standing (cm)	9.51±4.76 (-14–18)	47 (average)
	General physical fitness	373 (average)

TABLE 3. **ANALYSIS OF VARIANCE OF TEST SCORES: FOUR TESTS**

Tests & Groups	**Mean±SD (min–max)**	**Analysis of variance**	
Standing long jump [cm]			
Female teachers	134.90±11.258 (91.0–171.0)	**Z**	**p**
Preschool girls	84.64±19.624 (24.0–147.0)	19.4572	0.0000
Preschool boys	95.28±17.564 (39.0–146.0)	19.1704	0.0000
Grade 1 girls	92.35 ±18.396 (50.0–140.0)	17.4700	0.0000
Grade 1 boys	105.76±22.049 (50.0–170.0)	13.8471	0.0000
Grade 2 girls	108.28±18.569 (62.0–181.0)	14.8027	0.0000
Grade 2 boys	115.37±19.787 (75.0–162.0)	10.5274	0.0000
Grade 3 girls	106.58±24.260 (60.0–167.0)	12.6841	0.0000
Grade 3 boys	132.53±23.755 (79.0–190.0)	0.4574	0.6473
First-year female students	162.74±17.637 (111.0–211.0)	-16.0013	0.0000
4 x 10 m shuttle run [s]			
Female teachers	13.68±0.760 (11.78–16.07)	**Z**	**p**
Preschool girls	17.66±1.847 (13.67–26.00)	-19.8487	0.0000
Preschool boys	16.56±1.497 (13.00–21.00)	-18.2440	0.0000
Grade 1 girls	13.45±1.656 (10.70–19.06)	1.8915	0.0586
Grade 1 boys	13.13±1.709 (10.40–19.30)	5.1913	0.0000
Grade 2 girls	13.58±1.419 (10.50–18.06)	1.8517	0.0641
Grade 2 boys	12.86±1.572 (9.70–19.00)	7.7485	0.0000
Grade 3 girls	13.55±2.017 (9.30–21.00)	-0.5898	0.5553
Grade 3 boys	12.66±1.872 (8.80–19.56)	9.3230	0.0000
First-year female students	12.61±0.906 (10.28–15.87)	12.5649	0.0000
Skipping + hand clap in 8s	*[no. of claps]*		
Female teachers	24.11±2.914 (11–33)	Z	p
Preschool girls	12.69±2.738 (0–22)	19.9127	0.0000
Preschool boys	12.17±3.829 (0–21)	19.5132	0.0000
Grade 1 girls	15.48±3.804 (6–29)	16.4913	0.0000
Grade 1 boys	16.44±5.514 (4–41)	14.5039	0.0000
Grade 2 girls	18.50±5.017 (7–41)	13.6013	0.0000
Grade 2 boys	18.52±4.363 (11–30)	12.5396	0.0000
Grade 3 girls	19.27±7.014 (3–47)	11.4727	0.0000
Grade 3 boys	19.36±6.705 (4–44)	10.2757	0.0000
First-year female students	23.75±3.063 (16–36)	1.0941	0.2739

continued

TABLE 3. **ANALYSIS OF VARIANCE OF TEST SCORES: FOUR TESTS *(cont.)***

Tests & Groups	Mean±SD (min–max)	Analysis of variance	
Sit-ups 30s [no. sit-ups]			
Female teachers	14.78±4.084 (0–25)	**Z**	**p**
Preschool girls	6.70±3.948 (0–18)	17.1812	0.0000
Preschool boys	5.89±4.552 (0–17)	16.6956	0.0000
Grade 1 girls	11.82±4.958 (0–25)	6.5941	0.0000
Grade 1 boys	11.98±5.023 (0–27)	5.6563	0.0000
Grade 2 girls	15.49±5.892 (0–34)	-1.4698	0.1416
Grade 2 boys	15.53±5.514 (2–28)	-1.2473	0.2123
Grade 3 girls	17.18±5.799 (3–35)	-4.0722	0.0000
Grade 3 boys	18.53±4.656 (0–34)	-8.4756	0.0000
First-year female students	18.43±3.795 (7–27)	-9.4577	0.0000

z = standard score p = probability that the calculated value will be exceeded

The results of the analysis of variance for the *standing long jump*, *4x10m shuttle run*, *skipping with hand clapping* and *sit-ups in 30sec.* are presented in Table 3. A statistical analysis (Mann-Whitney U-test) revealed that EETs scored significantly higher (p=0.0000) than 6-year-old girls (by 50.26cm), 6-year-old boys (by 39.62cm), Grade 1 girls (by 42.55cm), Grade 1 boys (by 29.14cm), Grade 2 girls (by 26.62cm), Grade 2 boys (by 19.53cm), Grade 3 girls (by 28.32cm). No significant differences in results were noted between EETs and Grade 3 boys (p=0.6473). EETs scored significantly below (p=0.0000) the first-year female students (by 27.84cm) (Table 3).

In the *4x10m shuttle run*, EETs scored significantly higher (p=0.0000) than 6-year-old girls (by 3.98sec.) and 6-year-old boys (by 2.88sec.). No significant differences were reported between EETs and Grade 1 girls (0.23sec.), Grade 2 girls (0.1sec.) or Grade 3 girls (0.13sec.). The results scored by EETs were significantly below (p=0.0000) those of Grade 1 boys (by 0.55sec.), Grade 2 boys (by 0.82sec.), Grade 3 boys (by 1.02sec.) and first-year female students (by 1.07sec.) (Table 3).

The results scored by EETs in the *skipping with hand clapping* test were significantly higher (p=0.0000) in comparison with all preschool children and early elementary school students (Grades 1 to 3). No significant differences (p=0.2739) were observed between EETs and first-year female students (0.36 claps). In the *sit-ups* test, EETs scored significantly better results (p=0.0000) than preschool girls and boys (difference of 8.08 and 8.89 sit-ups, respectively) and Grade 1 girls and boys (difference of 2.96 and 2.8 sit-ups, respectively). No significant differences were noted between EETs and Grade 2 girls (p=0.1416) or Grade 2 boys (p=0.2123). EETs scored significantly below (p=0.0000) Grade 3 girls and boys (difference of 2.4 and 3.75 sit-ups, respectively), and first-year female students (3.65 sit-ups) (Table 3).

TABLE 4. **ANALYSIS OF VARIANCE OF TEST SCORES: 2nd FOUR TESTS**

Tests & Groups	**Mean±SD (min–max)**	**Analysis of variance**	
Bent arm hang on bar [s]			
Female teachers	5.36±3.599 (0–18.91)	**Z**	**p**
Preschool girls	6.64±6.125 (0–37)	-1.3997	0.1616
Preschool boys	4.99±4.012 (0–17)	1.8753	0.0607
Grade 1 girls	3.51±3.055 (0–15)	5.8746	0.0000
Grade 1 boys	5.14±4.847 (0–23)	1.8905	0.0587
Grade 2 girls	7.46±6.061 (0–36)	-3.8133	0.0001
Grade 2 boys	7.33±5.354 (0–30)	-3.8965	0.0001
Grade 3 girls	8.39±10.385 (0–62)	-0.8872	0.3750
Grade 3 boys	12.05±13.396 (0–82)	-5.7365	0.0000
First-year female students	5.97±3.966 (0–51.34)	0.9535	0.3403
Med. ball backw. throw [cm]			
Female teachers	633.69±84.416 (320–890)	**Z**	**p**
Preschool girls	125.79±33.819 (70–216)	20.2088	0.0000
Preschool boys	154.04±38.898 (70–287)	19.8349	0.0000
Grade 1 girls	176.91±88.949 (40–530)	18.1397	0.0000
Grade 1 boys	206.32±79.177 (70–540)	17.6269	0.0000
Grade 2 girls	268.90±74.180 (80–467)	17.9923	0.0000
Grade 2 boys	301.82±95.529 (100–570)	17.5971	0.0000
Grade 3 girls	249.84±97.249 (86–530)	18.1800	0.0000
Grade 3 boys	375.91±114.529 (70–690)	16.5235	0.0000
First-year female students	692.25±137.019 (350–1080)	-4.7290	0.0000
1min Burpee test [no. cycles]			
Female teachers	17.90±3.358 (9–25)	*Z*	p
Preschool girls	14.64±3.036 (6–24)	10.7550	0.0000
Preschool boys	15.96±4.706 (7–56)	7.2620	0.0000
Grade 1 girls	14.69±3.464 (5–32)	9.3772	0.0000
Grade 1 boys	13.43±4.296 (4–29)	10.5074	0.0000
Grade 2 girls	18.89±5.421 (8–36)	-0.3580	0.7203
Grade 2 boys	19.92±6.623 (6–37)	-2.5007	0.0123
Grade 3 girls	19.27±6.317 (7–35)	-1.2887	0.1975
Grade 3 boys	21.56±5.950 (7–45)	-7.1531	0.0000
First-year female students	17.81±2.857 (10–34)	0.5842	0.5591

continued

TABLE 4. **ANALYSIS OF VARIANCE OF TEST SCORES: 2nd FOUR TESTS *(cont.)***

Tests & Groups	Mean±SD (min–max)	Analysis of variance	
Down bend from stand.[cm]			
Female teachers	9.51±4.757 (-14–18)	**Z**	**p**
Preschool girls	1.80±4.010 (-22–10)	7.3019	0.0000
Preschool boys	0.76±3.645 (-20–11)	9.6537	0.0000
Grade 1 girls	1.52±5.674 (-28–16)	6.0970	0.0000
Grade 1 boys	0.29±5.024 (-20–10)	8.3151	0.0000
Grade 2 girls	-0.89±6.637 (-16–18)	8.9922	0.0000
Grade 2 boys	-0.59±5.526 (-21–16)	9.6337	0.0000
Grade 3 girls	1.63±6.316 (-15–21)	5.6976	0.0000
Grade 3 boys	0.53±5.217 (-27–14)	7.9317	0.0000
First-year female students	6.42±4.801 (-9–21)	-3.6556	0.0003

z = standard score p = probability that the calculated value will be exceeded

Early education teachers scored significantly higher (p=0.0000) in the *bent arm hang on bar* test in comparison with Grade 1 girls (by 1.85cm), whereas the differences observed between EETs and preschool girls (p=0.1616), preschool boys (p=0.0607), Grade 1 boys (p=0.0587), Grade 3 girls (p=0.3750) and first-year female students (p=0.3403) were not statistically significant. EETs' results were significantly below (p=0.0001) those scored by Grade 2 girls (by 2.1cm), Grade 2 boys (by 1.97 cm) and Grade 3 boys (p=0.0000, by 6.69 cm). In the *medicine ball backward throw* test, EETs performed significantly (p=0.0000) better than preschool children and early elementary school pupils, but significantly poorer (p=0.0000) than first-year female students (by 58.56cm) (Table 4).

In the *1-minute Burpee* test, the results scored by EETs were significantly higher (p=0.0000) than those noted in the group of preschool children (girls by 3.26 cycles; boys by 1.94 cycles) and Grade 1 students (girls by 3.21 cycles; boys by 4.47 cycles). No significant differences were observed between EETs and Grade 2 girls (p=0.7203), Grade 3 girls (p=0.1975) and first-year female students (p=0.5591). EETs performed significantly worse than Grade 2 boys (p=0.0123, by 2.02 cycles) and Grade 3 boys (p=0.0000, by 3.66 cycles) (Table 4). In the *downward bend* test, EETs scored significantly better results than preschool children did (p=0.0000), early elementary school pupils (p=0.0000) and first-year female university students (p=0.0003) (Table 4).

DISCUSSION

The physical fitness level of university students enrolled in early education programmes is insufficient to teach PE to children. The existing programmes do not provide future educators with sufficient practical skills in PE. In the vast majority of cases, the future EETs' exposure to physical culture is limited to obligatory PE classes at university. Many students are

excused from PE classes for medical reasons, and some may even have physical disabilities (Podstawski & Borysławski, 2014).

Low student recruitment criteria and narrow PE curricula contribute to low levels of competence and physical fitness among EETs. The hiring of PETs with insufficient fitness levels is highly detrimental to education, but unfortunately it is increasingly observed in school practice (Patton *et al.*, 2009). The role of PE, which received priority treatment in the early 20th century, seems to have declined in the modern schooling system (Sargent, 1900). The above observations were confirmed by the results of this study, which demonstrated that the general fitness level of EETs was average and, in some cases, similar to or significantly lower than that of early elementary school (Grades 1 to 3) pupils or even preschool children.

Some of the differences or the absence of differences between EETs and the pupils are easy to explain. Early education teachers can be expected to score significantly better than the preschool, as well as early elementary school pupils, in tests such as medicine ball backward throw where body height and weight play a key role (Stockbrugger & Hannel, 2001; Mayhew *et al.*, 2005). A reverse correlation was noted in the bent arm hang test where low body weight is a critical success factor (Milanese, *et al.*, 2010; Podstawski & Borysławski, 2012; Sheikh *et al.*, 2012). Early education teachers scored significantly poorer in the bent arm hang test because they were significantly heavier than the other participants were. Their body weight also negatively influenced their endurance and speed, as demonstrated by the results of the 1-minute Burpee test.

The fact that EETs scored significantly better than preschool and early elementary school children in the skipping with hand clapping test can also be logically justified. The above trial measures coordination ability (Mynarski, 2000), and a temporarily stagnant period in the development of motor coordination is noted in 7- to 10-year-olds (28% of girls and 22% of boys), whereas around 10% of children from the above age group may even experience regression (Hirtz, 1998). The motor coordination ability of 6-year-olds is very poorly developed in comparison with EETs (Bardaglio *et al.*, 2012; Leversen *et al.*, 2012).

In line with the principles of ontogenetic development, motor abilities increase steadily from childhood (7-9 years) and begin to decrease at the end of young adulthood (19-25 years) until old age (66-80 years) and death (Leversen *et al*, 2012). The highest level of motor competence is noted at the age of 20-30 years (Wilmore *et al.*, 2008), therefore, the fitness level of the analysed EETs could be expected to be significantly higher than those of preschool and early elementary school children and similar to that of first-year female students. In addition to motor skills, physical fitness also involves movement skills (Raczek, 2010), which should be acquired by early education students in different sport disciplines during a degree programme. The majority of PE students are highly physically active and fit individuals who score much higher results than those reported for the EETs in this study (Boraczyński & Boraczyńska, 2009; Hraski *et al.*, 2011; Wasiluk, 2011) and other students of Polish universities (Lisicki, 2004). For this reason, PE curricula for EETs should be expanded to include various sport disciplines and forms of physical activity.

It is highly probable that women's physical fitness deteriorates significantly after university graduation due to a lower level of participation in physical activity. This was reported about

Flemish (Duvigneaud *et al*., 2007) and American women (Church *et al.*, 2007), who did not aspire to become PE teachers. The low fitness level limits the teacher's ability to correctly demonstrate many exercises in class or set a positive example for the students (Zeigler, 2003). Teachers who do not have the required physical skills are unable to conduct the class in an interesting and effective manner, and they fail to foster positive changes in a child's motor development (Melville & Cardinal, 1997; Pagnano & Langley, 2001), in particular, when obligatory PE classes are the only form of physical activity in which children engage. A study in 2008 demonstrated that children taught by qualified PETs (graduates of a five-year university course in PE) were characterised by a significantly higher level of physical fitness than those exercising with EETs (Podstawski & Borysławski, 2014).

In the 1960s, attempts were made to raise the rank of PE in elementary schools in Poland, but they failed to produce the anticipated results (Jaworski, 2012). This was the result of a shortage of university graduates with a degree in PE (which was required to teach PE classes in Polish schools at the time), most of whom were employed in secondary schools. Today, PE graduates find it difficult to find employment in elementary schools because PE classes in Grades 1 to 3 are taught by EETs (Jaworski, 2012). As part of the integrated learning system in Grades 1 to 3, the same teacher teaches PE and other subjects. In Grades 1 to 3, 99% of teachers are women, and only 9% of them are fully qualified to teach PE (SIO DATA, 2009).

LIMITATIONS

One of the limitations of this study was the absence of publications analysing the level of physical fitness in PETs. Although this drawback contributes to the significance of our research, it prevents us from comparing the current results with other findings. The study covered only the Region of Warmia and Mazury. Our research should be continued in other Polish regions to produce reliable and comparable results. It should also be noted that 167 out of the 721 women (23.16%) who were invited to participate in the study were unable to perform any physical exercise due to medical certification or permanent damage to locomotive organs. Those results significantly deteriorated the general fitness level of EETs who took part in the study. A similar percentage (25%) of women with permanent disabilities was noted in a preliminary study, which revealed the lowest (unsatisfactory) level of motor competence in the majority of EETs tested (Podstawski *et al.*, 2013).

Physical fitness standards for Podstawski's Test were developed based on the results of women for whom, in the majority of cases, obligatory PE classes were the only form of physical activity (Podstawski, 2006). The International Committee on the Standardisation of Physical Fitness Tests (ICSPFT) (Pilicz *et al*., 2002) and Eurofit (Adam *et al*., 1988) applied similar principles in the process of developing test norms. New and more appropriate physical fitness standards should be proposed for EETs and qualified teachers who are PE graduates.

CONCLUSIONS

The average results scored by EETs in eight motor tests indicate that the teachers were characterised by an average level of general physical fitness (on a five-point grading scale). The results obtained by EETs in selected tests were significantly below those scored by early

elementary school pupils (4x10m shuttle run, sit-ups in 30s, bent arm hang on bar, 1-minute Burpee test) and first-year female university students (standing long jump, 4x10m shuttle run, sit-ups in 30s, medicine ball backward throw, downward bend from standing position). Physical fitness plays a very important role in the daily work of EETs. The average physical fitness level and a high rate of sick leave among EETs are an indication of:

- low level of physical activity in the evaluated group of teachers;
- the need for revised recruitment principles for early education programmes, including fitness tests; and
- the need to expand early education curricula to include PE classes.

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