

## MOTOR SKILLS

# Effects of an Educational Gymnastics Course on the Motor Skills and Health-Related Fitness Components of PETE Students

*Liana Webster*

### Abstract

*Many physical education teacher education (PETE) programs seek to develop teacher candidates' content knowledge through various physical activity courses. However, limited empirical evidence exists linking college physical activity courses to the development of skill or fitness. The purpose of the study was to examine the effects of an educational gymnastics course on PETE students' motor skill proficiency and health-related fitness components. Participants (N = 22) were PETE students enrolled in an educational gymnastics course. Data were collected from two primary sources: (1) four individual skills tests and the South Carolina Physical Education Assessment Program (SCPEAP) Elementary School Educational Gymnastics assessments and (2) the FitnessGram test battery. Findings suggest that an educational gymnastics course can improve PETE students' content knowledge/motor skill proficiency. Additionally, a relationship may exist between certain fitness indicators and motor skill level in educational gymnastics. This study may guide PETE programs in making decisions regarding the inclusion of educational gymnastics as a content course in their programs, as such a course may help ensure that teacher candidates are physically educated individuals who are able to demonstrate competent movement performance.*

---

Liana Webster is an assistant professor, Department of Kinesiology, Texas A&M University - Corpus Christi. Please send author correspondence to [Liana.Webster@tamucc.edu](mailto:Liana.Webster@tamucc.edu)

Standard 2 of the National Initial Physical Education Teacher Education Standards indicates that physical education teacher candidates are physically educated individuals with the knowledge and skills necessary to demonstrate competent movement performance and health-enhancing fitness (National Association for Sport and Physical Education [NASPE], 2008). Competence in motor skills is important to being an effective physical education teacher (Capel & Whitehead, 2015; Martens, Burwitz, & Zuckerman, 1976; Mitchell, 2007; NASPE, 2009; Staffo & Stier, 2000), because the teacher must be able to demonstrate properly for students to imitate good practice and become more proficient (Capel & Whitehead, 2015). Being personally fit is also important to being an effective physical education teacher (Cardinal, 2001; Gold, Petrella, Angel, Ennis, & Woolley, 2012; Kamla, Snyder, Tanner, & Wash, 2012; Melville & Maddalozzo, 1988; Mitchell, 2007; NASPE, 2009), because PE teachers who model a lifestyle that promotes fitness and physical activity are better able to reinforce student learning about fitness concepts and will influence their students to adopt similar lifestyles (Kamla et al., 2012).

One way that physical education teacher education (PETE) programs ensure that their majors are skillful in a variety of movement forms is by building their content knowledge via physical activity courses designed for PETE students (Ayvazo, Ward, & Stuhr, 2010). However, there is much variability in both the amount and types of content courses provided by PETE programs in colleges and universities in the United States (Bahneman & McGrath, 2004), with many programs seriously reducing the credit hours available for these courses (Siedentop, 2002). This variability is due to the long-standing issue of determining exactly what should represent the essential movement content core for PETE programs (Collier, 2006) and has been compounded by the issue of curricular space in these programs (Ayers & Housner, 2008).

Educational gymnastics is one content area commonly included in PETE programs. It is an activity with many benefits (Baumgarten & Pagnano-Richardson, 2010; Bean, 1977; Beaumont, 1979; Capel, 1986; Donham-Foutch, 2007; Hardy, 1978; Mauldon & Layson, 1979; Sloan, 2007; Werner, Williams, & Hall, 2012; Williams, 1987), and it has been described as a fundamental and critical part of the physical education curriculum that should be offered in preschool

through college (Donham-Foutch, 2007). One such benefit is that it promotes abilities related to health and fitness (Werner et al., 2012; Baumgarten & Pagnano-Richardson, 2010). Educational gymnastics is unique from other content areas in that it plays a role in sports and everyday life by helping people learn how to manage their bodies efficiently and safely (Werner et al., 2012). It is also unique in that an indirect teaching style and open-ended tasks are used, making it a developmentally appropriate activity that allows for differences in individual skill levels so that all participants can be successful at a task (Nilges, 2002).

The arguments in favor of educational gymnastics as an essential content area are plentiful, but limited empirical evidence exists linking physical activity courses to the development of content knowledge in the form of motor skill proficiency or fitness outcomes in PETE students. Few researchers have examined the relationship between educational gymnastics specifically and the development of skill and/or fitness. There is an emerging relationship between skill and fitness (Barnett, Beurden, Morgan, Brooks, & Beard, 2008; Stodden, Langendorfer, Goodway, Ferkel, & Gao, 2012; Stodden, Langendorfer, & Robertson, 2009; Webster et al., 2014), but the majority of studies in this area have been conducted on youth as opposed to college students. Furthermore, most researchers have not used gymnastics as a measure of skill. Perhaps the most relevant of these studies, Webster et al.'s (2014) study included an examination of the relationship between teacher fitness and movement competence in a series of gymnastics skills based on the role of motor competence in performing effective demonstrations of movement skills to learners (Webster et al., 2014). However, Webster et al. did not exclusively examine PETE students and included other education majors in their study.

The purpose of this study was to examine the effects of an educational gymnastics course on PETE students' motor skills and health-related fitness components. The three research questions driving this study were as follows: (1) Does instruction in an educational gymnastics course improve the motor skill levels of PETE students on selected educational gymnastics tasks? (2) Does participation in an educational gymnastics course improve the health-related fitness of PETE students? (3) Does a relationship exist between PETE stu-

dents' fitness and motor skill levels across the stages of content development in educational gymnastics?

## Method

### Participants and Setting

Participants ( $N = 22$ ) were PETE students enrolled in a mixed undergraduate–graduate educational gymnastics course during the Fall 2013 ( $n = 10$ ) and Spring 2014 ( $n = 12$ ) semesters at a large university in the Southeastern United States. Participants included 19 undergraduates ranging in age from 19 to 28 years old ( $M = 21.9$ ) and three master's students ranging in age from 22 to 23 years old ( $M = 22.3$ ). The mean age of all participants combined was 22.0 years. Nine participants were female and 13 were male. The researcher was the instructor of the course. The educational gymnastics class met approximately three times per week for a total of 41 class meetings over the course of each semester. Each class was 50 min in length. All class meetings occurred in an average-sized indoor gymnasium. All data collection for the study occurred during the scheduled class meeting times.

### Instrumentation

**Motor skills.** Motor skills were measured using the South Carolina Physical Education Assessment Program (SCPEAP) for Elementary School Educational Gymnastics (second and fifth grades) and four individual skills tests. The SCPEAP was originally formed to provide the South Carolina Department of Education with a valid and reliable assessment of physical education programs. SCPEAP materials were continually piloted and revised before their inclusion in the program and continually revised with teacher experience over more than 10 years (SCPEAP, 2010). The elementary school assessments were selected for this study because they most closely aligned with the content taught in the educational gymnastics course. Having each taught the educational gymnastics course in the past and used SCPEAP or similar assessments with university-level students, the researcher and one other expert in educational gymnastics determined this instrument to be valid with this population. The motor skills tests were divided into three stages. Stage 1 consisted of four individual skills. Stage 2 followed the SCPEAP second grade

test protocol involving a combination of skills. Stage 3 followed the SCPEAP fifth grade test protocol involving a sequence of skills.

A test of individual skills (Stage 1) was included to match the skill progression taught in the educational gymnastics class, which is practicing individual skills, followed by combining skills, and finally sequencing (Nilges, 1997). The test of individual skills was created by the researcher and one other educational gymnastics expert. Four basic skills were selected to represent each of the four foundational skills of educational gymnastics: rolling actions, balancing actions, step-like actions, and flight actions. A forward roll, a cartwheel, a still shape standing on one foot with arms out to the sides, and a tuck jump off of a block mat were selected, respectively. Each of the individual skills had three cues associated with quality performance.

For the combination of skills (second grade SCPEAP protocol), participants create, write, and perform a balance (a shape held still), a roll, and a different balance. Balances are to show at least two of the following changes: base of support, level, and shape. Participants are assessed on the clear shapes at the beginning and the end of the combinations and their ability to hold these shapes still for 3 s each. They are also assessed on how they perform the roll and the transitions (smoothness) getting into and out of the roll (SCPEAP, 2007).

For the sequence of skills (fifth grade SCPEAP protocol), participants create, write, and perform a gymnastics sequence including a beginning balance and different ending balance and four different movement elements. Movement elements include the following: mount, travel along, and dismount apparatus; turn or change of direction; change in speed; upright or inverted balance showing clear shapes and extensions held for 3 s; aerial movement shape in flight; a skill requiring some support on hands; and rolling. Participants are assessed on having a clear beginning and ending balance (held for at least 3 s with a clear body shape), demonstration of at least four movement elements with good technique, continuity/smooth transitions (one action logically linked to another with no extra steps), controlled use of momentum and balance, and the written narrative matching the performance (SCPEAP, 2007).

Rubrics were used to score participants on their ability to perform each of the six motor skills tests (four individual skills, a combination of skills, and a sequence of skills) at pre- and posttest. Each

rubric had four levels, with Level 3 as the highest possible score and Level 0 as the lowest. For the combination of skills, the better of the two performances was scored (SCPEAP, 2007). Interrater reliability was established between the researcher and the same expert who assisted in creating the individual skills tests.

A pilot study was used prior to this study to establish the stability of the motor skills assessments. Eleven undergraduate PETE students enrolled in the educational gymnastics course the semester before the study began served as participants. Participants were pretested one week and posttested the next week following the protocol described in the Procedures section (in the actual study, a full semester of educational gymnastics instruction occurred between pre- and posttest). The pilot study demonstrated that participants' scores on motor skills tests generally do not improve from pre- to posttest. This suggests that the motor skills assessments were stable and that participants' scores did not improve as a result of taking the test a second time. The pilot study also further validated the use of the SCPEAP for Elementary School Educational Gymnastics assessment with university-level students.

**Fitness.** Health-related fitness was assessed using established FitnessGram protocol (Meredith & Welk, 2010). The reliability and validity of the FitnessGram assessments are thoroughly documented in the *FitnessGram Reference Guide* (Plowman & Meredith, 2013). The specific FitnessGram test items used in this study were the PACER test for cardiovascular fitness, the 90° Push-Up and Curl-Up tests for muscular strength and endurance, the Back-Saver Sit and Reach test for flexibility, and the handheld bioelectrical impedance analyzer device for body composition.

**Physical activity recalls.** To account for participation in any outside activities that could affect health-related fitness or motor skills, PETE students completed physical activity recalls using the International Physical Activity Questionnaire (IPAQ) short version and responded to several additional questions. The IPAQ asks participants to provide information regarding the time that they spent being physically active in the last 7 days, focusing on the areas of vigorous physical activity, moderate physical activity, walking, and sitting. The reliability and validity of the IPAQ have been well established (IPAQ, 2002). Because the types of physical activities

performed were also of interest in this study, additional questions regarding time spent in cardiorespiratory, flexibility, and muscular strength/endurance activities were included as part of the physical activity recall process.

## **Procedures**

Approval to conduct this study was obtained from the university's institutional review board prior to data collection. A pretest–posttest design was used. Motor skills testing and fitness testing took place at baseline and again at the end of the semester. Physical activity recalls were completed every 2 weeks, for a total of eight recalls per participant. The researcher provided instructions and demonstrations on testing days. All testing was video recorded for later analysis. Trained assistants aided the researcher in video recording and monitoring participants during testing.

**Motor skills testing.** Enough mats for all participants to have their own were arranged in the gymnasium. Four video cameras on tripods were set at a wide angle to capture the participants' performances from the side. Each participant additionally had one block mat approximately 12 in. high to be used for the Stage 1 flight action skill. Participants were given worksheets for motor skills testing at baseline. For Stage 1, participants had 1 min to practice each skill, followed by performing each skill once on camera. For Stage 2, they had 5 min to plan and practice their combinations of skills using their worksheets. They then performed twice on camera, per SCPEAP protocol. Participants had 10 min to plan and practice their Stage 3 sequence using their worksheets. They performed their sequence once on camera, per SCPEAP protocol. Worksheets were collected at the end of the testing day. Participants performed the same combination and sequence on the test at the end of the semester as they did at baseline.

**Fitness testing.** The five fitness test stations were set up in separate areas of the gymnasium on fitness testing days. Participants completed each of the five tests as a class, with all participants finishing one test before moving on to the next. Participants recorded their own scores on a scoresheet immediately after each test was completed. Scoresheets were collected at the end of each testing day. The videos were later reviewed to check participants' self-recorded fitness test scores for accuracy.

**Treatment verification.** The researcher kept detailed records of all lessons taught during each semester, including specific tasks within lessons. Additionally, four lessons were videotaped each semester and analyzed using the Basic Academic Learning Time - Physical Education (B-ALT-PE) instrument, with attention to how much time was spent in activity and instruction on those days. This treatment verification confirmed that the nature of the course was consistent with educational gymnastics and that students had consistent opportunities within the class to develop skill.

## **Data Analysis**

**Motor skills.** The pre- and posttest scores on each motor skills assessment (four individual skills, a combination of skills, and a sequence of skills) were analyzed in separate related-samples Wilcoxon signed-rank nonparametric tests to determine if there was any improvement in educational gymnastics skills (Research Question 1).

**Fitness.** Pre- and posttest scores on each of the five fitness test items (PACER, Body Composition, Curl-Up, 90° Push-Up, and Back-Saver Sit and Reach) were analyzed using separate repeated-measures within-subjects analysis of variance (ANOVA) tests to determine if there were any improvements in fitness (Research Question 2). Fitness test scores were also analyzed descriptively to determine if they fell within the FitnessGram Healthy Fitness Zone ranges at pre- and posttest. A Spearman's rho correlation coefficient was used to analyze if any relationships existed between motor skill level and fitness (Research Question 3).

**Physical activity recalls.** Descriptive methods were used to analyze the types of activities in which students participated outside of the educational gymnastics class (cardiovascular endurance, flexibility, and muscular strength/muscular endurance) as well as the intensity of the activities (moderate and vigorous). Time spent in moderate to vigorous physical activities (MVPA) and fitness posttest scores were compared using a Spearman's rho correlation coefficient.

## **Results**

### **Motor Skills**

The related-samples Wilcoxon signed-rank tests revealed that participants' ability to perform each of the six selected educational

gymnastics tasks improved significantly from pre- to posttest. There was a significant increase in scores on the rolling action ( $p = .02$ ), the balancing action ( $p = .004$ ), the step-like action ( $p = .003$ ), the flight action ( $p = .001$ ), the combination of skills ( $p < .001$ ), and the sequence of skills ( $p < .001$ ) from pre- to posttest. The motor skills test results are presented in Table 1.

## **Fitness**

The separate repeated-measures within-subjects ANOVA tests revealed a significant improvement in scores on the Curl-Up test ( $p < .001$ ) and Body Composition test ( $p = .001$ ) from pre- to posttest. No significant differences were found between pre- and posttest scores on the 90° Push-Up test ( $p = .448$ ) or the Back-Saver Sit and Reach test ( $p = .148$ ). There appeared to be a significant decrease in scores on the PACER from pre- to posttest ( $p = .033$ ). Fitness test results are presented in Table 2.

One participant's PACER test scores met HFZ at pre- and posttest, and 21 participants' PACER test scores did not meet HFZ at pre- or posttest. For the 90° Push-Up test, 12 participants' scores met HFZ at pre- and posttest, five did not meet HFZ at pre- or posttest, four did not meet HFZ at pretest but met HFZ at posttest, and one met HFZ at pretest but not at posttest. On the Curl-Up test, 19 participants' scores met HFZ at pre- and posttest, one did not meet HFZ at pre- or posttest, and two did not meet HFZ at pretest but met HFZ at posttest. For the Back-Saver Sit and Reach test, 20 participants' scores met HFZ at pre- and posttest, one did not meet HFZ at pre- or posttest, and one did not meet HFZ at pretest but met HFZ at posttest. Nineteen participants' Body Composition test readings met HFZ at pre- and posttest, and three participants' readings did not meet HFZ at pre- or posttest. A summary of whether the participants met or did not meet the HFZ ranges at pre- and posttest is provided in Table 3.

**Table 1**  
*Motor Skills Test Results*

Stage/motor skill	Level	Pretest frequency	Pretest %	Posttest frequency	Posttest %	$\chi^2$	Asymptotic sig. (2-sided test)
Stage 1, Part 1: Rolling Action	0	0	0	0	0	21.0	.020
	1	1	4.5	0	0		
	2	5	22.7	0	0		
	3	16	72.7	22	100.0		
Stage 1, Part 2: Balancing Action	0	0	0	0	0	71.5	.004
	1	1	4.5	0	0		
	2	17	77.3	9	40.9		
	3	4	18.2	13	59.1		
Stage 1, Part 3: Step-Like Action	0	2	9.1	0	0	55.0	.003
	1	2	9.1	1	4.5		
	2	9	40.9	5	22.7		
	3	9	40.9	16	72.7		
Stage 1, Part 4: Flight Action	0	0	0	0	0	97.5	.001
	1	4	18.2	1	4.5		
	2	15	68.2	9	40.9		
	3	3	13.6	12	54.5		
Stage 2: Combination	0	17	77.3	0	0	190.0	< .001
	1	5	22.7	7	31.8		
	2	0	0	7	31.8		
	3	0	0	8	36.4		
Stage 3: Sequence	0	18	81.8	0	0	253.0	< .001
	1	4	18.2	2	9.1		
	2	0	0	14	63.6		
	3	0	0	6	27.3		

**Table 2***Fitness Test Results*

Test	Pretest	Pretest	Posttest	Posttest	<i>F</i>	Sig.
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>		
PACER	33.50	13.60	27.68	14.83	5.23	.033
90° Push-Up	15.77	8.78	16.41	7.90	.598	.448
Curl-Up	26.96	13.25	36.91	14.29	25.82	< .001
Back-Saver Sit and Reach	12.39	2.18	12.80	2.83	2.25	.148
Body Composition	20.13	7.34	18.65	7.65	14.61	.001

**Table 3***Healthy Fitness Zones Met or Not Met at Pre and Post*

Test	Met pre and post	Not met	Not met at	Met at pre, not at post
		at pre or post	pre, met at post	
PACER	1	21	0	0
90° Push-Up	12	5	4	1
Curl-Up	19	1	2	0
Sit and Reach	20	1	1	0
Body Composition	19	3	0	0

**Physical Activity Recalls**

**IPAQ questions.** Three positive correlations (one strong) were found between scores on the PACER posttest and MVPA reported on a physical activity recall. A significant positive correlation was found between PACER posttest scores and MVPA reported on Recall 1 ( $r = .448, p = .037$ ), Recall 7 ( $r = .677, p = .001$ ), and Recall 8 ( $r = .451, p = .035$ ). Six positive correlations (two strong) were found between scores on the 90° Push-Up posttest and MVPA reported on a recall. A significant positive correlation was found between 90° Push-Up posttest scores and MVPA reported on Recall 1 ( $r = .452, p = .035$ ), Recall 4 ( $r = .452, p = .035$ ), Recall 5 ( $r = .493, p = .02$ ), Recall 6 ( $r = .539, p = .01$ ), Recall 7 ( $r = .590, p = .004$ ), and Recall 8 ( $r = .434, p = .044$ ). A significant positive correlation was found between Sit and Reach posttest scores and MVPA reported on Recall 7 ( $r = -.493, p = .02$ ). Three negative correlations (one strong) were

found between readings on the Body Composition posttest and MVPA reported on a recall. A significant negative correlation was found between Body Composition posttest readings and MVPA reported on Recall 1 ( $r = -.569, p = .006$ ), Recall 3 ( $r = -.460, p = .031$ ), and Recall 6 ( $r = -.525, p = .012$ ). The results of the comparisons of time spent in MVPA and fitness posttest scores are shown in Table 4.

**Table 4**

*Correlations Between Time Spent in MVPA and Fitness Posttest Scores*

MVPA recall	PACER post	Push-up post	Curl-up post	Sit and reach post	Body comp post
Recall 1					
Correlation Coefficient	.448*	.452*	.211	-.163	-.569**
Sig. (2-tailed)	.037	.035	.345	.469	.006
Recall 2					
Correlation Coefficient	.367	.273	-.051	.052	-.264
Sig. (2-tailed)	.093	.219	.823	.820	.235
Recall 3					
Correlation Coefficient	.218	.403	.057	-.059	-.460*
Sig. (2-tailed)	.330	.063	.800	.794	.031
Recall 4					
Correlation Coefficient	.077	.452*	.202	-.080	-.407
Sig. (2-tailed)	.732	.035	.368	.724	.060
Recall 5					
Correlation Coefficient	.359	.493*	.090	-.156	-.407
Sig. (2-tailed)	.101	.020	.689	.489	.060
Recall 6					
Correlation Coefficient	.400	.539**	.295	-.262	-.525*
Sig. (2-tailed)	.065	.010	.182	.239	.012
Recall 7					
Correlation Coefficient	.677**	.590**	.402	-.493*	-.316
Sig. (2-tailed)	.001	.004	.063	.020	.152
Recall 8					
Correlation Coefficient	.451*	.434*	.195	-.355	-.273
Sig. (2-tailed)	.035	.044	.385	.105	.218

Note.  $N = 22$ .

\*Correlation is significant at the 0.05 level (2-tailed).

\*\*Correlation is significant at the 0.01 level (2-tailed).

**Additional questions.** Five cardiovascular endurance activities were reported between all physical activity recalls, including cycling, dance, running, swimming, and playing tag. Reported flexibility activities included stretching, Pilates, and yoga. Muscular strength and endurance activities varied the most, with 21 types of activities reported between all recalls. Reported activities included badminton, baseball, basketball, bowling, cheerleading, dodgeball, educational games, flying disc sports, golf, football, kickball, lacrosse, push-ups, racquetball, soccer, softball, tumbling, Ultimate, volleyball, weight lifting, and wrestling.

### **Relationship Between Motor Skills and Fitness**

The Spearman's rho correlation coefficient revealed a significant relationship between pretest scores on the PACER and three of the selected educational gymnastics tasks and between pretest Body Composition readings and scores on two of the educational gymnastics tasks. A significant positive correlation was found between pretest scores on the PACER and the rolling action ( $r = .517, p = .014$ ), the flight action ( $r = .598, p = .003$ ), and the combination of skills ( $r = .480, p = .024$ ). A significant negative correlation was found between pretest readings on Body Composition and the rolling action ( $r = -.481, p = .024$ ) and between Body Composition and the flight action ( $r = -.451, p = .035$ ).

The Spearman's rho correlation coefficient revealed a significant relationship between posttest scores on the PACER and two of the educational gymnastics tasks and between posttest scores on the Curl-Up and one of the educational gymnastics tasks. A strong positive correlation was found between the flight action and PACER posttest scores ( $r = .667, p = .001$ ). A significant negative correlation was found between the sequence and PACER posttest scores ( $r = -.497, p = .019$ ). A strong positive correlation was found between the step-like action and Curl-Up posttest scores ( $r = .648, p = .001$ ). A correlation could not be reported between the rolling action posttest scores and any of the fitness posttest scores because 100% of the PETE students performed the rolling action at a Level 3 (the highest level) at posttest. The results of the pre- and posttest comparisons between motor skills and fitness are presented in Tables 5 and 6, respectively.

**Table 5***Correlations Between Motor Skills Pretest and Fitness Pretest Scores*

<b>Motor skill</b>	<b>PACER Pre</b>	<b>Push- Up Pre</b>	<b>Curl- Up Pre</b>	<b>Sit and Reach Pre</b>	<b>Body Comp Pre</b>
<b>Rolling Action Pre</b>					
Correlation Coefficient	.517*	.370	-.188	-.051	-.481*
Sig. (2-tailed)	.014	.090	.401	.823	.024
<b>Balancing Action Pre</b>					
Correlation Coefficient	-.103	-.109	-.287	-.140	-.031
Sig. (2-tailed)	.647	.629	.196	.533	.890
<b>Step-Like Action Pre</b>					
Correlation Coefficient	.199	.032	.364	.196	.060
Sig. (2-tailed)	.374	.889	.095	.383	.790
<b>Flight Action Pre</b>					
Correlation Coefficient	.598**	.354	.225	-.257	-.451*
Sig. (2-tailed)	.003	.106	.315	.248	.035
<b>Combination Pre</b>					
Correlation Coefficient	.480*	.052	.043	.198	-.120
Sig. (2-tailed)	.024	.819	.848	.376	.596
<b>Sequence Pre</b>					
Correlation Coefficient	.093	-.132	.142	.112	.065
Sig. (2-tailed)	.680	.560	.529	.618	.774

*Note.*  $N = 22$ .

\*Correlation is significant at the 0.05 level (2-tailed).

\*\*Correlation is significant at the 0.01 level (2-tailed).

**Table 6***Correlations Between Motor Skills Posttest and Fitness Posttest Scores*

<b>Motor skill</b>	<b>PACER post</b>	<b>Push- up post</b>	<b>Curl- up post</b>	<b>Sit and reach post</b>	<b>Body comp post</b>
Rolling Action Post					
Correlation Coefficient	.	.	.	.	.
Sig. (2-tailed)	.	.	.	.	.
Balancing Action Post					
Correlation Coefficient	-.154	.037	-.073	.044	-.051
Sig. (2-tailed)	.494	.872	.746	.846	.822
Step- Like Action Post					
Correlation Coefficient	.381	.398	.648**	.105	-.168
Sig. (2-tailed)	.080	.067	.001	.642	.456
Flight Action Post					
Correlation Coefficient	.667**	.177	.001	-.084	-.254
Sig. (2-tailed)	.001	.431	.998	.709	.254
Combination Post					
Correlation Coefficient	-.023	.174	.181	-.172	.172
Sig. (2-tailed)	.918	.438	.421	.445	.443
Sequence Post					
Correlation Coefficient	-.497*	-.229	.095	.217	.048
Sig. (2-tailed)	.019	.304	.674	.332	.833

*Note.*  $N = 22$ .

\*Correlation is significant at the 0.05 level (2-tailed).

\*\*Correlation is significant at the 0.01 level (2-tailed).

## Discussion

### Conclusions

This study examined the effects of an educational gymnastics course on PETE students' motor skill development and health-related fitness components. Based on the findings of the study, at least three conclusions can be drawn. The first conclusion is that instruction in an educational gymnastics course improves motor skill levels of PETE students. This is significant to teacher education because an

increase in motor skill proficiency reflects an increase in content knowledge in educational gymnastics. The findings provide evidence that activity courses such as the one delivered in this study help PETE programs contribute to the motor skill development/content knowledge of PETE students as mandated by the National Initial PETE Standards (NASPE, 2008). As a result of their increases in skill in educational gymnastics, the PETE students in this study may be better prepared to present educational gymnastics content to their future students.

A second conclusion is that instruction in an educational gymnastics course does not significantly improve the health-related fitness of PETE students on most of the fitness tests used in this study. Findings indicate that PETE students had significantly better abdominal strength and endurance and a lower percentage of body fat by the end of the course. However, PETE students' upper body strength and endurance and their flexibility did not improve significantly, and cardiovascular endurance appeared to be worse. Participation in the educational gymnastics course may have contributed to the improvement in scores on the Curl-Up and Body Composition tests. Many educational gymnastics tasks required PETE students to utilize their abdominal muscles, which may have favorably affected Curl-Up test scores. PETE students were engaged in MVPA at almost every class meeting, which may have contributed to a lower percentage of body fat by the end of the semester. Participation in physical activities outside of class time during the semester may also have contributed to improved scores. The results indicate that a relationship may exist between the time that the PETE students spend in MVPA outside of educational gymnastics class time and certain health-related fitness indicators at posttest. Activities reported on the physical activity recalls such as weight lifting may have affected Curl-Up test scores. Any of the 29 reported activities may have affected body composition. Additionally, PETE students' dietary patterns (which were not accounted for in this study) could have affected their body compositions.

Flexibility did not improve as significantly as expected after participation in an educational gymnastics course, and attention should be drawn to the PETE students' scores in relation to the FitnessGram HFZ ranges. Twenty of the 22 scores already fell within the HFZ

range on the Back-Saver Sit and Reach at pretest. Therefore, there may have been a ceiling effect in that the PETE students did not improve much further on this test at posttest. There may have been a similar ceiling effect on the 90° Push-Up test, for which 13 PETE students' scores already fell within the HFZ range at pretest. As for the PACER, results of the statistical test indicated that scores significantly decreased from pre- to posttest, but in terms of the HFZ range on the PACER, there were no changes in scores for any of the 22 PETE students from pre- to posttest. The standard deviation was large, meaning that data points (total laps scored) were spread out over a large range and there was a higher than normal amount of variability in the data. Motivation to perform may also explain the apparent decrease in cardiovascular endurance at posttest.

Standard 2 of the National Initial PETE Standards indicates that physical education teacher candidates should achieve and maintain a health-enhancing level of fitness throughout their programs. Physical education teacher candidates should meet the age- and gender-specific levels for each of the five components of health-related physical fitness using standards established for national-, state-, or program-level testing. Performing below the age- and gender-specific levels for just one of the five components of health-related fitness using standards established for national-, state-, or program-level testing is considered to be unacceptable (NASPE, 2008). Based on the PACER posttest scores alone, 21 of the 22 PETE students in this study had unacceptable fitness levels. Several performed below the age- and gender-specific levels for two or more of the five fitness tests. Strategies for more directly targeting fitness in PETE programs are needed. One possibility is to attempt to get more out of the content courses that majors take by targeting fitness in one or more of these courses within a PETE program.

A third conclusion is that although several significant relationships exist between motor skill level and health-related fitness, overall the results of this study do not provide overwhelming support for a relationship between motor skill competency and fitness. The only significant correlation between motor skills and fitness that was present at pre- and posttest was between the flight action and the PACER test. The relationships found support Webster et al. (2014), who examined the relationship between preservice teachers' health-related

fitness and movement competency in gymnastics. They found that skill on a variety of educational gymnastics tasks was significantly correlated with muscular strength/endurance, particularly on the Curl-Up test. The work of Webster et al. provided initial evidence that preservice teachers' health-related fitness is related to their movement competency.

### **Limitations**

One limitation of this study was the relatively small sample size ( $N = 22$ ) due to low enrollment in the educational gymnastics course. Another limitation was the lack of a control group. Enrollment in the course was too low to easily support using a control group, and it would have been unethical to have students enrolled in a required course for PETE majors be randomly assigned to sit out. A third limitation was the possible effect of physical activity participation outside of class time on participants' motor skill levels and health-related fitness.

### **Directions for Future Research**

The results of this study are promising, particularly when it comes to the value of content courses in developing motor skills, but further research is needed. Studying the effects of physical activity courses on the development of motor skills in PETE students in content areas other than educational gymnastics is warranted. Expanding out of the area of educational gymnastics is important because different movement forms have the ability to affect fitness in different ways. There are as many possibilities for future studies here as there are content areas in physical education. Investigating the relationship between motor skill levels and teaching performance could be another extension of this study.

This study demonstrates the effects that one physical activity course in the content area of educational gymnastics can have on the motor skills and health-related fitness components of PETE students. The results of this study warrant broad support for the use of motor skill content courses to increase PETE students' motor skills in various content areas. PETE programs may use the evidence that this study provides to make important decisions regarding the inclusion of educational gymnastics and other content courses in their programs. These decisions will directly affect the content knowledge

of physical education teachers as they enter the field and ultimately the programs and students they serve.

## References

- Ayers, S. F., & Housner, L. D. (2008). A descriptive analysis of undergraduate PETE programs. *Journal of Teaching in Physical Education, 27*, 51–67. <https://doi.org/10.1123/jtpe.27.1.51>
- Ayvazo, S., Ward, P., & Stuhr, P. T. (2010). Teaching and assessing content knowledge in preservice physical education. *Journal of Physical Education, Recreation, and Dance, 81*(4), 40–44. <https://doi.org/10.1080/07303084.2010.10598463>
- Bahneman, C., & McGrath, J. (2004). *Analysis of the undergraduate physical education teacher certification activity requirements within the United States*. Paper presented at the American Alliance of Health, Physical Education, Recreation, and Dance, New Orleans, Louisiana.
- Barnett, L. M., Beurden, E. V., Morgan, P. J., Brooks, L. O., & Beard, J. R. (2008). Does childhood motor skill proficiency predict adolescent fitness? *Medicine and Science in Sports and Exercise, 40*, 2137–2144. <https://doi.org/10.1249/MSS.0b013e31818160d3>
- Baumgarten, S., & Pagnano-Richardson, K. (2010). Educational gymnastics: Enhancing children's physical literacy. *Journal of Physical Education, Recreation, and Dance, 81*(4), 18–25. <https://doi.org/10.1080/07303084.2010.10598460>
- Bean, D. (1977). Educational gymnastics in practice: An examination of some problems within the process at elementary school level. *CAHPER Journal, 43*, 3–13.
- Beaumont, G. (1979). Educational gymnastics and traditional pedagogy. *Bulletin of Physical Education, 15*(2), 18–22.
- Capel, S. (1986). Educational gymnastics: Meeting physical education goals. *Journal of Physical Education, Recreation, and Dance, 57*, 34–38. <https://doi.org/10.1080/07303084.1986.10606041>
- Capel, S., & Whitehead, M. (2015). *Learning to teach physical education in the secondary school* (4th ed.). Oxon, United Kingdom: Routledge.
- Cardinal, B. J. (2001). Role modeling attitudes and physical activity and fitness promoting behaviors of HPERD professionals and pre-professionals. *Research Quarterly for Exercise and Sport, 72*, 84–90. <https://doi.org/10.1080/02701367.2001.10608937>

- Collier, C. (2006). Models and curricula of physical education teacher education. In D. Kirk, D. Macdonald, & M. O'Sullivan (Eds.), *The handbook of physical education* (pp. 386–406), London, England: Sage. <https://doi.org/10.4135/9781848608009.n22>
- Donham-Foutch, S. (2007). Teaching skills and health-related fitness through a preservice gymnastics program. *Journal of Physical Education, Recreation, & Dance*, 78(5), 1–58. <https://doi.org/10.1080/07303084.2007.10598022>
- Gold, R. R., Petrella, J., Angel, J., Ennis, L. S., & Woolley, T. W. (2012). The qualities of physical education teachers based upon students' perceptions of physical appearance. *Journal of Instructional Psychology*, 39(2).
- Hardy, L. (1978). Educational gymnastics: A teacher's view. *British Journal of Physical Education*, 9, 163.
- International Physical Activity Questionnaire. (2002). IPAQ questionnaires. Retrieved from <http://www.ipaq.ki.se>
- Kamla, J., Snyder, B., Tanner, L., & Wash, P. (2012). Are physical education majors models for fitness? *Journal of the Southeastern Regional Association of Teacher Educators*, 22(1), 16–22.
- Martens, R., Burwitz, L., & Zuckerman, J. (1976). Modeling effects on motor performance. *Research Quarterly*, 47, 277–291.
- Mauldon, E., & Layson, J. (1979). *Teaching gymnastics* (2nd ed.). London, England: MacDonald and Evans.
- Melville, D. S., & Maddalozzo, J. G. F. (1988). The effects of a physical educator's appearance of body fatness on communicating exercise concepts to high school students. *Journal of Teaching in Physical Education*, 7, 343–352. <https://doi.org/10.1123/jtpe.7.4.343>
- Meredith, M. D., & Welk, G. J. (2010). *FITNESSGRAM/ACTIVITYGRAM test administration manual* (Updated 4th ed.). Champaign, IL: Human Kinetics.
- Mitchell, M. (2007). Choosing an active lifestyle: “Don't do as I do; Do as I say.” *Journal of Physical Education, Recreation, and Dance*, 78(4), 4–9. <https://doi.org/10.1080/07303084.2007.10597994>
- National Association for Sport and Physical Education. (2008). *National standards and guidelines for physical education teacher education* (3rd ed.). Reston, VA: Author.

- National Association for Sport and Physical Education. (2009). *A philosophical position on physical activity and fitness for physical activity professionals* [Position paper]. Reston, VA: Author.
- National Council for Accreditation of Teacher Education. (2006). What makes a teacher effective? A summary of key research findings on teacher preparation. Retrieved from <http://www.ncate.org/>
- Nilges, L. (1997). Educational gymnastics: Stages of content development. *Journal of Health, Physical Education, Recreation, and Dance*, 68(3), 50–55. <https://doi.org/10.1080/07303084.1997.10604911>
- Nilges, L. (2002). Content specific pedagogy for effective teaching in educational gymnastics. *Teaching Elementary Physical Education*, 13(3), 7–9.
- Plowman, S. A., & Meredith, M. D. (Eds.). (2013). *FITNESSGRAM/ACTIVITYGRAM reference guide* (4<sup>th</sup> ed.). Dallas, TX: The Cooper Institute.
- Siedentop, D. (2002). Content knowledge for physical education. *Journal of Teaching in Physical Education*, 21, 368–377. <https://doi.org/10.1123/jtpe.21.4.368>
- Sloan, S. (2007). An investigation into the perceived level of personal subject knowledge and competence of a group of pre-service physical education teachers towards the teaching of secondary school gymnastics. *European Physical Education Review*, 15, 337–364. <https://doi.org/10.1177/1356336x07072674>
- South Carolina Physical Education Assessment Program. (2007). Grade level notebooks. Retrieved from <http://www.scahperd.org/scpeap.html>
- South Carolina Physical Education Assessment Program. (2010). Grade level notebooks. Retrieved from <http://scahperd.org/resources/scpeap/>
- Staffo, D. F., & Stier, W. F., Jr. (2000). The use of fitness tests in PETE programs. *Journal of Physical Education, Recreation, and Dance*, 71(5), 48–52. <https://doi.org/10.1080/07303084.2000.10605146>

- Stodden, D., Langendorfer, S., Goodway, J., Ferkel, R., & Gao, Z. (2012). Examining the dynamic relationship between motor competence, perceived motor competence, and physical fitness in children: The relationships among motor skill competence and health-related fitness across childhood. *Journal of Sport and Exercise Psychology*, *34*, S13.
- Stodden, D., Langendorfer, S., & Robertson, M. A. (2009). The association between motor skill competence and physical fitness in young adults. *Research Quarterly for Exercise and Sport*, *80*, 223–229. <https://doi.org/10.1080/02701367.2009.10599556>
- Webster, C. A., Webster, L., Cribbs, J., Wellborn, B., Lineberger, B., & Doan, R. (2014). The relationship between preservice teachers' health-related fitness and movement competency in gymnastics. *The Physical Educator*, *71*, 203–217.
- Werner, P. H., Williams, L. H., & Hall, T. J. (2012). *Teaching children gymnastics* (3rd ed.). Champaign, IL: Human Kinetics.
- Williams, J. (1987). *Themes for educational gymnastics* (3rd ed.). London, England: A & C Black.