Croatian Journal of Education
Vol.17; Sp.Ed.No.3/2015, pages: 213-225
Preliminary communication
Paper submitted: 13th November 2013
Paper accepted: 12th May 2014
doi: 10.15516/cje.v17i0.1139

Obstacle Polygon as an Assessment of Fundamental Movement Skills in 6-Year-Old Children

Franjo Lovrić[1], Igor Jelaska[2] and Žarko Bilić[1]
[1]*Department for Physical Education, Faculty of Science and Education, University of Mostar*
[2]*Faculty of Kinesiology, University of Split*

Abstract

The study was conducted in order to determine the appropriateness of assessment of the level of fundamental movement skill development of six-year-old children by using an obstacle polygon. In accordance with the aim of the study, a sample of 78 six-year-old pupils (39 boys and 39 girls) was used. Through high inter-item correlation and high Cronbach's alpha coefficient, the results clearly indicate excellent reliability of the measuring instrument. Furthermore, normality of the distribution clearly points to the good discriminative power of the polygon. The t-test showed no differences between boys and girls in both the applied polygon and morphological features. The results of the multiple regression analysis with two predictors showed no impact of the used morphological features on the performance of fundamental movement skill assessment manifested through the obstacle polygon. The obtained results clearly point to a very high applicability of the polygon in the physical education curriculum as an instrument for assessment and verification of fundamental movement skills among six-year-old children.

Key words: *metric characteristics; motor learning; physical education curriculum; regression analysis.*

Introduction

Fundamental movement skills are natural forms of movement and can be defined as basic movement activities which form a basis for more advanced and more specific

motor activities, such as sport-specialized skills (Wickstrom, 1983). In scientific studies they are qualified as skills that enable children to manage space (Zittel, 1994), but also enable a practical response to a different stimuli (Krebs, 2000). From a kinesiological aspect, it is important to emphasize that children who do not master these basic patterns of motor skills will probably be unable to successfully and effectively participate in sports and other educational activities throughout their lives (Gallahue & Donnelly, 2003). Therefore, one of the fundamental tasks of kinesiology education is to improve stability skills, locomotor skills and manipulative skills which build the motor foundation necessary for a normal development of fundamental movement skills (Findak et al., 1998; Prskalo, Babin, & Bavčević, 2010; Prskalo, 2013). Scientific studies clearly indicate that it is necessary to establish adequate kinesiological programs and construct reliable and valid instruments to monitor the degree of motor and other skill and knowledge acquisition (Bavčević, Babin, & Prskalo, 2006; Žuvela, Božanić, & Miletić, 2011; Jelaska, Maleš, & Kuna, 2011).

Namely, there is continuity and positive impact of fundamental movement skills on general and specific motor skills, keeping in mind that continuous physical activity is the key factor for their development (Gallahue & Ozmun, 1998; Findak et al., 1998).

It is important to emphasize that the assessment tests of fundamental movement skills can be quantitative – where the result of the performance is measured, and qualitative – where the quality of performance is assessed by referees. Regardless of the type of the test and the area of fundamental movement skills, the question arises as to the extent to which the morphological status will impact the success of the fundamental movement skills performance. This will certainly provide guidelines to teachers on how to structure physical education curricula, depending on the level of fundamental movement skills as well as the morphological status of the observed population of students.

As it is particularly important to gain insight into the level of development of fundamental movement skills as early as possible (Burton & Miller, 1998) and all with the purpose to identify developmental changes, in this paper the obstacle polygon for the assessment of fundamental movement skills which is designed and validated on the sample of eight-year-old children (Žuvela et al., 2011) will be applied to six-year-old children. Therefore, the first objective of this paper is to establish some metric characteristics (reliability) of the mentioned obstacle polygon. Furthermore, the existence of the differences between boys and girls will be tested as well as the impact of morphological features on the success of the applied polygon.

Methods

The sample of participants included 78 (39 boys and 39 girls) six-year-old children, attending the first grade of elementary school "Fra Didak Buntić" in Čitluk. In order to assess fundamental movement skills an obstacle polygon was used (Žuvela et al., 2011). An obstacle polygon was designed with its reliability and validity tested

on a sample of eight-year-old children. More precisely, the polygon is based on the scientifically founded hierarchy of fundamental movement skills (Findak et al., 1998) and includes the following tasks: passing and catching a volleyball against the wall as representing motor skills for object manipulation, jumping over sponge obstacles 50 cm high as representing motor skill to overcome obstacles, lifting and carrying medicine balls 3 kg weight as representing motor skills to overcome resistance and 20 m run as representing motor skills to master space. The result required to overcome the polygon (PFMS) was recorded with a pair of photocells. All subjects were also measured by variables: body height (BH) and body weight (BW). All measurements were repeated three times. To gain a more detailed view of the morphological features of the observed sample, the body mass index (BMI) was also calculated.

Descriptive statistical parameters were calculated, normality of variables distribution was tested by the Kolmogorov-Smirnov test and in order to determine the reliability Cronbach's alpha coefficient and average inter-item correlation were calculated. Differences between boys and girls were determined by using the t-test for independent samples. The impact of morphological features on the success of the applied polygon was determined through a multiple regression analysis. Statistical analysis was conducted using software package Statistica™ Ver 10.

Results and Discussion

Table 1 shows descriptive statistical parameters of the polygon for the assessment of fundamental movement skills, body height and weight as well as body mass index (BMI), mean (M), minimum result (Min), maximum result (Max), standard deviation (SD), the significance of the Kolmogorov-Smirnov test (KS-p), the coefficient of asymmetry (Skew) and the coefficient of kurtosis (Kurt).

Table 1

Descriptive statistical indicators: arithmetic mean (M), standard deviation (SD), minimum score (Min), maximum score (Max), skewness coefficient (Skew) and coefficient of kurtosis (Kurt), significance of the Kolmogorov-Smirnov test (KS-p).

	M±SD	Min	Max	Skew	Kurt	KS-p
PFMS	29.01±3.51	22.97	37.04	0.26	-0.88	0.09
BH	124.12±5.37	111.40	135.60	-0.14	-0.40	0.06
BMI	16.04±2.10	13.40	23.50	1.82	3.61	0.15
BW	24.83±4.58	18.90	41.90	1.47	2.64	0.14

Legend**:** PFMS – polygon of fundamental movement skills, BH – body height, BMI – body mass index, BW – body weight.

As can be seen from Table 1, the normality of distribution was tested with the Kolmogorov-Smirnov test. The results clearly indicate that all measured variables have a distribution that does not significantly differ from a normal distribution, so we can say that the subjects are successfully differentiated according to the object of measurement and that the applied polygon has an adequate discriminative power. It is necessary to emphasize that the variable PFMS obtained almost identical significance

as on the sample of eight-year-old children (KS-p=0.08) (Žuvela et al., 2011). This additionally points to the possibility that the polygon of fundamental movement skills is applicable to the population described in the sample used. Furthermore, within Table 2 the results of the reliability analysis of the measurement instrument are presented.

Table 2

Reliability of the obstacle polygon as an assessment of fundamental movement skills. Cronbach's alpha coefficient (α), average inter-item correlation (Ilr)

	PFMS1	PFMS2	PFMS3	α	Ilr
PFMS1				0.95	0.88
PFMS2	0.89*				
PFMS3	0.84*	0.90*			

Legend: PFMS – polygon with obstacles; * – statistically significant correlation coefficients (p<0.05).

In Table 2, correlation matrix, Cronbach's alpha coefficient and the average inter-item correlation between measurements of the polygon for fundamental movement skill assessment are presented. It is visible that the correlation between particles of the applied polygon is very high and statistically significant. The Cronbach's alpha coefficient on the sample of six-year-old children obtained in this study is identical to the coefficient obtained on the sample of eight-year-old children α=0.95 (Žuvela et al., 2011). The results clearly indicate a very high reliability of the measuring instrument. In order to determine whether there are differences between boys and girls in fundamental movement skills, i.e. the applied polygon, as well as in morphological features, the t-test was used (Table 3).

Table 3

Differences between boys and girls determined by t-test for independent samples (M1 –mean for boys, M2 –mean for girls, t – test value, df – degrees of freedom, p – level of significance)

	M1	M2	t	df	P
PFMS	28.43	29.59	-1.47	76	0.15
BH	124.75	123.49	1.03	76	0.31
BMI	15.78	16.30	-1.10	76	0.27
BW	24.61	25.04	-0.41	76	0.68

Legend: PFMS – with obstacles, BH – body height, BMI – body mass index, BW – body weight.

Table 3 above shows that boys and girls do not differ significantly according to the applied variables. The results obtained are also in accordance with the study conducted on eight-year-old children, as well as with other studies that showed the absence of significant gender differences in overall motor performance (Butterfield, Lehnhard, & Coladarci, 2002; Netelenbos, 2001a, 2001b). Consequently, we can say that gender is not likely to contribute to the difference between boys and girls in efficiency of

performance on this obstacle polygon. On the other hand, there are also studies in which a significant difference between genders in the fundamental movement skills has been determined (Woodard, & Surburg, 1997; Krebs, 2000; Ulrich, 2000). By comparing fundamental movement skills that are assessed in these studies it can be concluded that the differences between genders were obtained only in studies which mostly analyzed manipulative fundamental movement skills (Žuvela et al., 2011). The absence of differences between boys and girls in the applied polygon, the compliance with the educational process, as well as relatively easy implementation of the mentioned, clearly indicates an appropriateness of the implementation of this platform in physical education curriculum. These facts further indicate high practical significance of designing the polygon for fundamental movement skill assessment as an instrument for assessment and verification of an obstacle polygon in carrying out the physical education curriculum.

Table 4

Results of regression analysis between variable for the assessment of fundamental movement skills (PFMS) and morphological features as predictor variables (BETA – regression coefficients, R – multiple correlation coefficients, R^2 – determination coefficient, p – level of significance)

	PFMS			
Variables	Boys		Girls	
	BETA	p – level	BETA	p – level
BH	-0.53	0.05	-0.40	0.08
BW	0.25	0.35	0.42	0.06
R	0.36		0.32	
R^2	0.13		0.10	
p	0.0002		0.0016	

Legend: PFMS – polygon with obstacles, BH – body height, BW – body weight.

Table 4 presents the results of multiple regression analysis with the set of morphological variables as predictors and efficiency on the obstacle polygon as a criterion. After gaining insight into the results, it is obvious that the multiple regression model is statistically significant in a sample of boys and girls though, partially observing, none of the observed morphological features significantly affect the criterion variable – polygon performance. It is important to emphasize that the variable BMI was not used in the set of predictor variables considering that this variable is a composite of other applied variables. The coefficient of multiple correlation among boys implicitly confirms the absence of differences obtained by the t-test. The set of predictor variables explains 13% and 10% of variability in performance of polygon for boys and girls, respectively. Accordingly, approximately 87% of criterion variable variability can be attributed to some other anthropological features, which points out the fact that the set of monitored predictor variables should be supplemented with additional anthropological status variables. The results obtained are consistent with the ones obtained on the sample of eight-year-old children (Žuvela

et al., 2011) where, also, the impact of morphological features was not determined with the exception of body height which proved to be significant in the sample of eight-year-old children (-0.32).

Conclusion

In order to revalidate the obstacle polygon for fundamental movement skills assessment and determine the influence of morphological features on the performance on the above-mentioned polygon, the study was conducted on a sample of 78 six-year-old children, first grade pupils in elementary school. It showed that the used obstacle polygon has excellent metric characteristics when observing the polygon globally. The fact that the structure of the test is multi-factorial and by its application a general insight of motor skills and abilities can be obtained puts it aside from tests which only measure manifestation of a particular latent dimension. Furthermore, it has been determined that there is no morphological feature impact on the efficiency of performance. It was also determined that there is no difference between boys and girls in the efficiency of polygon performance as well as in applied morphological features. Consequently, observing the polygon globally, boys and girls can be treated as a single sample. It is necessary to emphasize that the results of regression analysis indicate no significant impact of applied morphological features on the efficiency of polygon performance. The results obtained clearly indicate the practicality and applicability of this polygon in the physical education curriculum as an instrument for evaluation and verification of fundamental movement skills.

Additionally, the value of this study can also be viewed through its contribution in polygon revalidation on the sample of six-year-old children, which is composed of representatives of fundamental movement skills and in a simple and relatively quick way provides insight into the situation and the level of fundamental movement skills development. The deficiency of this work and a consideration for all studies of this type is to further identify and explain the partial effect of all the tasks that are included in the polygon. This would provide better insight into the development of certain areas of fundamental movement skills, which would, ultimately, result in a more complete and improved knowledge of fundamental movement skills, both, globally and by segments.

For future studies the task would be to make polygon revalidation for other lower grades of elementary school, as well as for the preschool age. This would certainly allow continuous monitoring and insight of fundamental movement skills of children from the earliest age with a single instrument. In this way, in a timely manner we may affect the development, improvement and control of fundamental skills on which the improvement and further development of general and specific motor skills depends on. These cognitions give significance to the polygon itself and consequently emphasize the need for its integration in the processes of physical education.

References

Bavčević, T., Babin, J., & Prskalo, I. (2006). Complex group organizational forms – an optimizing factor in Physical education instruction. *Kinesiology, 38*(1), 28-39.

Burton, A. W., & Miller, D. E. (1998). *Movement Skill Assessment*. Champaign, IL: Human Kinetics.

Butterfield, S. A., Lehnhard, R. A., & Coladarci, T. (2002). Age, sex, and body mass index in performance of selected locomotor and fitness tasks by children in grades K-2. *Perceptual and Motor Skills*, *94*(1), 80-86. http://dx.doi.org/10.2466/pms.2002.94.1.80

Findak, V., Metikoš, V., Mraković, M., Neljak, B., & Prot, F. (1998). *Applied Kinesiology in the school system – motor skills*. Zagreb: Faculty of Physical Education, University of Zagreb.

Gallahue, D. L., & Donnelly, F. C. (2003). *Developmental physical education for all children* (4th ed.). Champaing, IL: Human Kinetics.

Gallahue, D. L., & Ozmun, J. C. (1998). *Understanding motor development: infants, children, adolescents, adults* (4th ed.). Dubugue, Iowa: McGraw-Hill.

Jelaska, I., Maleš, B., & Kuna, D. (2011). Influence of learning process on the relations between chosen anthropometric dimensions via linear, parabolic and cubic relation model. *Croatian Journal of Education*, *13*(1), 76-98.

Krebs, P. (2000). *Mental retardation*. In J. P. Winnick (Ed.), *Adapted Physical Education and Sport* (pp. 111-126). Champaign. IL: Human Kinetics.

Netelenbos, J. B. (2001a). *Motorische Ontwikkeling van kinderen, hanboek 1, introductie*. Boom: Amsterdam.

Netelenbos, J. B. (2001b). *Motorische Ontwikkeling van kinderen, hanboek 2, theorie*. Boom: Amsterdam.

Prskalo, I., Babin, J., & Bavčević, T. (2010). Methodical organizational forms of work and their effectiveness in kinesiology education. *Metodika*, *20*(1), 113-123.

Prskalo, I. (2013). Kinesiological Activities and Leisure Time of Young School-Age Pupils in 2007 and 2012. *Croatian Journal of Education*, *15*(1), 109-128

Ulrich, D. A. (2000). *Test of Gross Motor Development*. Austin: Pro-Ed Publishers.

Wickstrom, R. L. (1983). *Fundamental movement patterns* (3rd ed.) Philadelphia: Lea and Febirger.

Woodard, R. J., & Surburg, P. R. (1997). Fundamental gross motor skill performance by girls and boys with learning disabilities. *Perceptual and Motor Skills*, *84*, 867-870. http://dx.doi.org/10.2466/pms.1997.84.3.867

Zittel, L. L. (1994). Gross motor assessment of preschool children with special needs: Instrument selection considerations. *Adapted Physical Activity Quarterly*, *11*, 245-260.

Žuvela, F., Božanić, A., & Miletić, Đ. (2011). Polygon – A new fundamental movement skills test for 8 year old children: construction and validation. *Journal of Sport Science and Medicine*, *10*, 157-163.

Franjo Lovrić
Department for Physical Education, Faculty of Science and Education, University of Mostar
Ulica Matice hrvatske b.b., 88000 Mostar, Bosnia and Herzegovina
franjo.lovric@hotmail.com

Igor Jelaska
Faculty of Kinesiology, University of Split
Teslina 6, 21000 Split, Croatia
jelaska@kifst.hr

Žarko Bilić
Department for Physical Education, Faculty of Science and Education, University of Mostar
Ulica Matice hrvatske b. b., 88000 Mostar, Bosnia and Herzegovina
zarko@eromerc.com

Poligon prepreka u funkciji procjene biotičkih motoričkih znanja šestogodišnjaka

Sažetak

Istraživanje je provedeno s ciljem utvrđivanja prikladnosti i mogućnosti procjene stupnja razvijenosti biotičkih motoričkih znanja šestogodišnjaka koristeći se poligonom prepreka. U skladu s navedenim koristit će se uzorak od 78 učenika (39 dječaka, 39 djevojčica) u dobi od 6 godina. Kroz visoke iner-item korelacije i visoki Chronbach alpha koeficijent, rezultati jasno ukazuju na zadovoljavajuću pouzdanost mjernog instrumenta. Nadalje, rezultati KS testa jasno ukazuju na dobru strukturu odnosno osjetljivost poligona. T-testom je utvrđeno nepostojanje razlika između dječaka i djevojčica kako u primijenjenom poligonu tako i u morfološkim karakteristikama. Nadalje, rezultati višestruke regresijske analize sa dva prediktora pokazali su da ne postoji utjecaj morfoloških karakteristika na izvedbu poligona za procjenu biotičkih motoričkih znanja. Dobiveni rezultati nedvosmisleno ukazuju na praktičnost i primjenjivost poligona u nastavnom procesu tjelesne i zdravstvene kulture kao sredstva za procjenu i provjeru biotičkih motoričkih znanja.

Ključne riječi: *morfološke karakteristike; motoričko učenje; regresijska analiza; tjelesna i zdravstvena kultura.*

Uvod

Biotička motorička znanja podrazumijevaju prirodne oblike kretanja, a definiraju se kao standardne motoričke aktivnosti koje tvore osnovu za naprednije i specifičnije motoričke aktivnosti, poput specijaliziranih sportskih znanja (Wickstrom, 1983). Znanstvena istraživanja ih karakteriziraju kao ona znanja koja djeci omogućuju kretanje u prostoru (Zittel, 1994), ali i svrsihodnije reagiranje na različite podražaje (Krebs, 2000). S aspekta kineziološke edukacije važno je istaknuti da djeca koja ne svladaju te temeljne uzorke motoričkih znanja, vjerojatno neće moći uspješno i učinkovito sudjelovati u sportskim, ali ni u drugim odgojno-obrazovnim aktivnostima tijekom svog života (Gallahue i Donnelly, 2003). Stoga je zasigurno jedan od fundamentalnih stavaka kineziološke edukacije unaprijediti znanja stabilnosti,

lokomotorna i manipulativna znanja, kao podlogu za stvaranje motoričkih temelja za normalan razvoj biotičkih motoričkih znanja (Findak, Metikoš, Mraković, Neljak i Prot, 1998; Prskalo, 2013).

Istraživanja ukazuju na to da je neophodno formirati adekvatne kineziološke programe te konstruirati pouzdane i valjane instrumente za praćenje stupnja usvojenosti biotičkih motoričkih znanja i drugih znanja i vještina (Bavčević, Babin i Prskalo, 2006; Žuvela, Božanić i Miletić, 2011, Jelaska, Maleš i Kuna, 2011).

Naime, postoji kontinuitet i pozitivan utjecaj biotičkih motoričkih znanja kako na opća tako i na specifična motorička znanja, s tim da je kontinuirana tjelesna aktivnost ključni faktor za njihov razvoj (Gallahue i Ozmun, 1998; Findak i sur., 1998).

Važno je naglasiti da se testovi za procjenu biotičkih motoričkih znanja mogu podijeliti na kvantitativne – u kojima se mjeri rezultat izvedbe i kvalitativne – kod kojih se od sudaca procjenjuje kvaliteta izvođenja. Bez obzira na to o kojoj se vrsti testa i području biotičkih motoričkih znanja radi postavlja se pitanje koliko će morfološki status imati utjecaj na uspješnost izvedbe biotičkih motoričkih znanja. To će zasigurno dati smjernice učiteljima za strukturiranje programa tjelesne i zdravstvene kulture u ovisnosti o razini biotičkih motoričkih znanja kao i o morfološkom statusu ciljane populacije učenika.

Cilj rada

Kako je od posebne važnosti što prije dobiti uvid u stupanj razvijenosti biotičkih motoričkih znanja (Burton i Miller, 1998), a sve s ciljem identificiranja razvojnih promjena, u ovom će se radu poligon za procjenu biotičkih motoričkih znanja, konstruiran i validiran na uzorku osmogodišnjaka (Žuvela i sur., 2011), primijeniti na šestogodišnjacima. Stoga je prvi cilj ovog rada utvrditi neke metrijske karakteristike poligona za procjenu biotičkih motoričkih znanja (Žuvela i sur., 2011). Nadalje, ispitat će se postojanje razlika između dječaka i djevojčica, kao i utjecaj morfoloških karakteristika na uspješnost izvedbe primijenjenog poligona.

Metode rada

Uzorak ispitanika sastoji se od 78 šestogodišnjaka, polaznika prvog razreda osnovne škole fra Didaka Buntića u Čitluku od kojih je 39 dječaka i 39 djevojčica.

Za procjenu biotičkih motoričkih znanja koristio se poligon (Žuvela i sur., 2011). Poligon je konstruiran i metrijski ispitan od autora na uzorku osmogodišnjaka. Poligon se temelji na podjeli biotičkih motoričkih znanja (Findak i sur., 1998), a sastavljen je od sljedećih zadataka: dodavanje i hvatanje odbojkaške lopte od zida za motorička znanja manipulacije objektima, preskakanje preko spužvenih prepreka u visini od 50 cm za motorička znanja savladavanja prepreka, podizanje i nošenje medicinske lopte od 3 kg za motorička znanja savladavanja otpora i trčanje 20 m za motorička znanja svladavanja prostora. Rezultat potreban z+a svladavanje poligona bilježen je parom fotoćelija. Svi ispitanici mjereni su u varijablama: visina tijela (ATV), tjelesna masa (ATT) i indeks tjelesne mase (BMI).

Izračunati su deskriptivni statistički pokazatelji, normalitet distribucije varijabli ispitan je Kolmogorov-Smirnovljevim testom, a s ciljem utvrđivanja pouzdanosti izračunati su Chrobach alpha koeficijent i međučestična korelacija. Razlike između dječaka i djevojčica utvrđene su t-testom za nezavisne uzorke. Utjecaj morfoloških karakteristika na uspješnost izvedbe primijenjenog poligona utvrđen je višestrukom regresijskom analizom. Obrada podataka napravljena je u programskom sustavu Statistica™, verzija 10.

Rezultati i rasprava

U tablici 1. prikazani su deskriptivni statistički pokazatelji poligona za procjenu biotičkih motoričkih znanja, visine i mase tijela, kao i indeksa tjelesne mase: aritmetička sredina (AS), minimalni rezultat (Min), maksimalni rezultat (Max), standardna devijacija (SD), signifikantnost Kolmogorov-Smirnovljeva testa (KS-p), koeficijent asimetričnosti (Skew) i koeficijent spljoštenosti (Kurt).

Tablica 1.

Kako je vidljivo iz tablice 1, normalitet distribucije utvrđen je KS testom. Sve primijenjene varijable imaju distribuciju koja značajno ne odstupa od normalne pa možemo tvrditi kako uspješno razlikuju ispitanike po predmetu mjerenja i imaju zadovoljavajuću osjetljivost. Potrebno je istaknuti da je na varijabli PBMZ dobivena gotovo identična značajnost kao na uzorku osmogodišnjaka (KS-p=0,08) (Žuvela i sur., 2011). Navedeno dodatno ukazuje na mogućnost da je poligon biotičkih motoričkih znanja u pogledu osjetljivosti primjenjiv na testiranom uzorku. Nadalje, unutar tablice 2 nalaze se rezultati analize pouzdanosti mjernog instrumenta.

Tablica 2.

U tablici 2. prikazana je matrica korelacija, Chronbach alpha koeficijent i prosječna korelacija između čestica poligona za procjenu biotičkih motoričkih znanja. Možemo vidjeti kako je međučestična korelacija primijenjenog poligona vrlo visoka i statistički značajna. Chronbach alpha koeficijent na uzorku šetogodišnjaka dobiven u ovom radu identičan je koeficijentu dobivenom na uzorku osmogodišnjaka α=0,95 (Žuvela i sur., 2011). Rezultati nedvosmisleno ukazuju na vrlo visoku pouzdanost mjernog instrumenta. S ciljem utvrđivanja razlike između dječaka i djevojčica u biotičkim motoričkim znanjima, odnosno primijenjenom poligonu, kao i u morfološkim karakteristikama koristio se t-test (Tablica 3).

Tablica 3.

Iz tablice 3 vidljivo je da se dječaci i djevojčice ne razlikuju značajno u primijenjenim varijablama. Dobiveni rezultati također su u skladu s istraživanjem provedenim na osmogodišnjacima (Žuvela i sur., 2011), kao i s drugim istraživanjima u kojima je utvrđeno nepostojanje značajnih spolnih razlika u ukupnim motoričkim rezultatima (Butterfield, Lehnhard i Coladarci, 2002; Netelenbos, 2001a, 2001b). Zato možemo

tvrditi da vjerojatno spol nije ono što pridonosi razlici dječaka i djevojčica u uspješnosti izvedbe navedenog poligona. No također postoje istraživanja kod kojih je utvrđena razlika između spolova u biotičkim motoričkim znanjima (Woodard i Surburg, 1997; Krebs, 2000; Ulrich 2000). Usporedbom biotičkih motoričkih znanja, koja se procjenjuju u navedenim istraživanjima, može se zaključiti kako su razlike između spolova dobivene samo u istraživanjima koja su većim dijelom analizirala manipulativna biotička motorička znanja (Žuvela i sur., 2011). Nepostojanje razlika između dječaka i djevojčica u primijenjenom poligonu, uz usklađenost s nastavnim procesom, kao i njegova relativno laka istog, nedvosmisleno ukazuju na nužnost provedbe tog poligona u nastavi tjelesne i zdravstvene kulture. Navedene činjenice dodatno ukazuju na praktični značaj konstrukcije poligona za procjenu biotičkih motoričkih znanja, kao sredstva njihove procjene i provjere u realizaciji nastavnog procesa tjelesne i zdravstvene kulture.

Tablica 4.

U tablici 4. prikazani su rezultati regresijske analize između skupa morfoloških varijabli s uspješnošću izvedbe poligona za procjenu biotičkih motoričkih znanja. Uvidom u rezultate može se uočiti da je regresijski model statistički značajan na uzorku dječaka i djevojčica iako, parcijalno promatrajući, nijedna promatrana morfološka karakteristika ne utječe značajno na kriterijsku varijablu – izvedbu poligona. Potrebno je naglasiti da se varijabla BMI nije koristila u skupu prediktorskih varijabli s obzirom na to da je kompozit ostalih korištenih varijabli. Može se uočiti granična razina značajnosti varijable ATV kod oba poduzorka ispitanika. Uračunavajući veličinu uzorka, navedeni rezultat ukazuje na mogućnost identifikacije varijable ATV kao važnog prediktora u odnosu na promatrani kriterij. Koeficijent višestruke korelacije kod dječaka implicitno potvrđuje nepostojanje razlika dobivenih t-testom. Skup prediktorskih varijabli objašnjava kod dječaka 13%, a kod djevojčica 10% varijabiliteta izvedbe poligona na promatranom uzorku. Shodno tome, približno 87% varijabiliteta kriterijske varijable može se pripisati nekim drugim antropološkim obilježjima, što nam ukazuje na činjenicu da je skup promatranih prediktorskih varijabli nužno proširiti dodatnim varijablama antropološkog statusa. Dobiveni su rezultati u skladu s onima dobivenim na uzorku osmogodišnjaka (Žuvela i sur., 2011) na kojem također nije utvrđen utjecaj morfoloških karakteristika s iznimkom tjelesne visine koja se kod osmogodišnjih dječaka pokazala kao značajna (-0,32).

Zaključak

Istraživanje je provedeno na uzorku šestogodišnjaka, polaznika prvog razreda osnovne škole, s ciljem revalidacije poligona za procjenu biotičkih motoričkih znanja i utvrđivanja utjecaja morfoloških karakteristika na njegovu izvedbu. Rezultati ukazuju na dobre metrijske karakteristike gledajući poligon u cijelosti. Činjenica da je test višefaktorske strukture i da se njegovom primjenom dobiva generalna slika motoričkih

znanja, ali i sposobnosti, izdvaja ga od testova kojima se mjere manifestacije samo pojedine latentne dimenzije. Nadalje, utvrđeno je da ne postoji utjecaj morfoloških karakteristika na uspješnost izvedbe. Također je utvrđeno da ne postoji razlika između dječaka i djevojčica u uspješnosti izvedbe poligona, kao i u primijenjenim morfološkim karakteristikama. Zbog toga, promatrajući poligon u cijelosti, dječake i djevojčice možemo tretirati kao jedan uzorak. Potrebno je istaknuti da su rezultati regresijske analize pokazali da ne postoji značajan utjecaj primijenjenih morfoloških karakteristika na izvedbu poligona. Dobiveni rezultati nedvosmisleno ukazuju na praktičnost i primjenjivost tog poligona u nastavnom procesu tjelesne i zdravstvene kulture kao sredstva za procjenu i provjeru biotičkih motoričkih znanja.

Dodatno, vrijednost ovoga rada možemo gledati i u doprinosu revalidaciji poligona na uzorku šestogodišnjaka, koji je sastavljen od predstavnika biotičkih motoričkih znanja, a na jednostavan i relativno brz način omogućuje uvid u stanje i stupanj razvijenosti biotičkih motoričkih znanja. Nedostatak rada i ono što bi bilo poželjno u svim istraživanjima ovakvog tipa jest dodatno utvrditi i objasniti parcijalni utjecaj svih zadataka od kojih je poligon sastavljen. Na taj se način pravodobno može utjecati na razvijanje, poboljšanje i vrednovanje biotičkih motoričkih znanja o čijoj će razvijenosti ovisiti i nadogradnja i daljnji razvoj i općih i specifičnih motoričkih znanja.

U budućim istraživanjima potrebno je učiniti revalidaciju poligona i u ostalim nižim razredima primarnog obrazovanja i u predškolskom uzrastu. To bi zasigurno omogućilo kontinuirano praćenje i uvid u status biotičkih motoričkih znanja djece od najranijeg uzrasta. Na taj se način pravodobno može utjecati na razvijanje, poboljšanje i kontrolu biotičkih znanja od čijoj će razvijenosti ovisiti i nadogradnja i daljnji razvoj općih, ali i specifičnih motoričkih znanja. Upravo navedene spoznaje poligonu daju vrijednost i ističu potrebu za njegovom integracijom u nastavni proces tjelesne i zdravstvene kulture.