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How Much Do Our Elementary School Students Know About Health-Related Fitness? A Cross-Sectional Observational Study

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Abstract

The cognitive component of Health-Related Fitness (HRF) is particularly important for the student population and plays a significant role in promoting a healthy lifestyle and physical activity. This research aims to analyze the level of HRF knowledge of fifth and sixth-grade elementary school students in relation to gender, grade, and participation in sports. The sample consisted of 222 fifth and sixth grade students at elementary school of both sexes (110 girls), selected at random from different classes of the four elementary schools. The HRF knowledge assessment was done with a questionnaire having 28 questions with four answer options, one of which was correct. Students achieved 40.14% correct responses (Mean = 11.24 ± 3.39). A statistically significant difference in the HRF test was found between students of different grades (p = .038) and different levels of participation in sports (p = .001). The cluster analysis based on the HRF questionnaire identified two characteristic clusters of students. The first cluster consisted of students with an average score of 8.57 ± 1.83 points (30.6% correct answers). This cluster contained a higher proportion of students who were predominantly male, attended the fifth grade, and relatively more represented non-participate in sports. The second cluster consisted of students with an average score of 14.17 ± 1.91 (50.6% correct answers), who participated in sports and were predominantly female. These results are a cause for concern and indicate the necessity of focusing more intently on the acquisition of the necessary knowledge about HRF among elementary school-age students and their greater involvement in sports activities.

Keywords: HRF questionnaire · gender · grade · sport activity · relations

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Introduction

Health-related fitness

The initial attempts to define the importance of health-related fitness focused on general norms and recommendations for physical activity. In 1980, the American Alliance for Health, Physical Education, Recreation and Dance announced the first significant guidelines and reference values and laid the foundations for studying health-related fitness. Thereafter, elements related to diseases and fatal outcomes were introduced instead of exclusively sports performance, whereby fitness started to be considered an indicator of positive health (Lamb et al., 1988). This way of thinking about fitness led to the concept of health-related fitness as an ability of an individual, both for the energetic performance of daily activities and to reduce the risk for the development of chronic diseases (Ortega et al., 2015). Research into how physical activity improves endurance (Mateo-Orcajada et al., 2022) confirmed this idea. Furthermore, research has revealed a negative correlation between fitness and various types of chronic diseases, as well as interactions between different types of physical activity and these diseases (Chaput et al., 2020). Additionally, there are findings that support a positive correlation between an active lifestyle and cognitive functioning (Erickson et al., 2019), along with evidence that training can positively impact social and emotional outcomes (Field & Temple, 2017).

Cognitive part of health-related fitness

The cognitive part, or rather knowledge, stands out as an important element of health-related fitness. This part, named physical literacy, is defined by UNESCO as "the ability to identify, understand, interpret, create, respond effectively and communicate, using the embodied human dimension, within a wide range of situations and contexts. Physical literacy involves a continuum of learning in enabling individuals to achieve their goals, to develop their knowledge and potential, and to participate fully in their community and wider society" (Whitehead, 2013, p. 25). This multidimensional concept (Cornish et al., 2020) is first and foremost important to HRF because of its connection to the degree of physical activity (Haible et al., 2020). It is important to emphasize that physical literacy is not the goal itself, but the means of encouraging health maintenance through physical activity (Whitehead, 2019).

Contemporary problems of health status and physical activity

Raising awareness of the importance of health-related fitness among researchers and decision makers has led to growing interest in the level of physical activity in the population. Unfortunately, studies in many countries indicate that the situation is worsening. Woessner et al. (2021), for example, found an alarming decrease in physical activity and movement in everyday life among the sample of Australian students. These findings corroborate previous findings, which revealed general increases in sedentary lifestyles among both adults and students alike (Guthold et al., 2020; Tapia-Serrano et al., 2022). Some research showed a negative correlation between the degree of health-related fitness and a sedentary lifestyle (Chen et al., 2017). At the same time, researchers have identified various misconceptions regarding exercise (Hodges et al., 2014).

In our country, the State Institute for Public Health of Serbia has indicated a visible increase in health problems in the general population. Furthermore, it emerged that a very small percentage of students fulfilled the recommended 60 daily minutes of physical activity (Rodríguez-Rodríguez et al., 2020). Marković et al. (2021) also observed an increasing trend in overweight and obesity among preschool-aged students.

Research problem

In an earlier study (Miličković & Krneta, 2025), we primarily analyzed the psychometric characteristics of the Serbian version of the HRF knowledge. The questionnaire showed satisfactory psychometric characteristics (Cronbach's $\alpha = 0.73$; McDonald's $\omega = 0.73$) and with minimum corrections was applied in the present study.

This research aims to analyze the level of HRF knowledge of fifth and sixth-grade elementary school students in relation to gender, grade, and participation in sports. The specific new contribution of the present study is the examination of students' knowledge of health-related fitness in relation to gender, grade, participation in sports and motor abilities. It is assumed that the level of knowledge students possess regarding health-related fitness (HRF) is not commensurate with that which would be expected.

Method

The research was carried out as a cross-sectional observational study to investigate primary school students' knowledge of HRF. The data were collected during the second semester of 2025/2026

school year in four elementary schools. Before conducting the testing, permission was obtained from the school administration, and consent was obtained from the parents of all students. Given the nature of the research and the permissions obtained, approval from an ethics committee was not sought.

Participants

The sample examined consisted of 222 students of both genders (110 female) in the fifth (119) and sixth (103) grades of elementary school. Of the six primary schools contacted, four approved of the implementations of the research. In each of the four elementary schools, one out of three classes from both grades were randomly selected by drawing from a hat to participate in the research. All students in these classes participated in the study. In addition to the basic characteristics of the sample, data on students' participation in sports were also collected. At the time of the test, all examinees were healthy and capable of taking the tests.

Measurement instrument

The students' knowledge of HRF was assessed using a questionnaire, which has been adapted to the Serbian language and fitness environment (Miličković & Krneta, 2025) and was originally developed by Hodges et al. (2015). In relation to the questionnaire in that research, two questions were supplemented with added explanations of the terms used: the term flexibility in questions number 6, 11, 23 and 28 was further specified as "joint mobility" and the term overload in question number 25 as "additional muscle load". The questionnaire consists of 28 questions, each with four possible answers, one of which is correct. The questions cover several aspects of HRF: practicing physical activity outside of school; personal reactions to physical activity; characteristics of physical activities in relation to health; knowledge of strengths and weaknesses related to health; improved personal physical condition; knowledge of recommendations related to the improvement of physical condition; and knowledge of specific advantages related to every physical condition related to health. The student's score on the questionnaire is formed by adding up the correct answers to the questions and expressing them as a percentage of success. In accordance with the findings of the HRF questionnaire in the study by Hodges et al. (2016), which was conducted on a sample of fifth-grade students, this study employed a 50% success rate to describe and compare the results.

The questionnaire also covered data on the students' gender, grade, and participation in sports. Participation in sports meant that the student had been engaged in a sports activity at school or a sports club for at least one year.

Measurements of body height and body mass were taken to determine their body mass index (BMI). These anthropometric measurements were taken according to the standard protocol in the morning hours; the students were in sports equipment and barefoot. The measurement was carried out with the use of a medical scale Birotehna SD-301.

The motor status of the subjects was assessed with a standard battery of motor tests: 20-m shuttle run - for endurance assessment, bent arm hang – for static strength assessment, 30-sec sit-ups – for repetitive strength assessment, standing long jump – for assessing explosive power; sit and reach – for assessing flexibility; and 4 × 10 m shuttle run – for agility assessment.

Research design and procedure

A cross-sectional observational study was conducted with the objective of collecting data on the current situation of primary school students in the fifth and sixth grades regarding HRF. The HRF questionnaire was completed during the teacher's class session. The students were informed of the questionnaire's purpose and objective, provided with explicit instructions on how to respond, and assured that their responses would be anonymous and would not impact their academic grades. All the motor tests were conducted during their PE classes in a standard sports hall using proper equipment and instruments. The PE teachers and the lead researcher were responsible for the measurement process.

Statistical analyses

The statistical analyses of the HRF questionnaire involved determining the correct answers based on the responses and calculating the percentage of correct answers for specific questions. This was performed for both the total sample of students and for the defined categories. The results of the questionnaire were calculated as an aggregate HRF-score of correct answers. The basic descriptive statistics of anthropometric measurements, motoric tests, and HRF-score included the determination of the arithmetic mean and standard deviation for all variables ($M \pm SD$). The normality of the distribution of the HRF-score and other continuous variables was tested using the Shapiro-Wilk test.

The differences between students in terms of gender, grade, and participation in sports for the HRF-score variable were determined using a three-factor Analysis of Variance, with a level of statistical significance of $p \leq .05$. The calculation of the Partial

η^2 effect size (Cohen, 1988) and Levene's Test of Equality of Error Variances was also conducted.
The application of cluster analysis and subsequent logistic regression was undertaken as a form of exploratory supplementary analysis.
A two-step cluster analysis was conducted based on the results of the HRF test to examine whether there is a characteristic grouping of students. This analysis was performed using automatic cluster number determination, log-likelihood distances, Schwarz's Bayesian criterion (BIC), and the Silhouette measure of cohesion and separation. The demographic profile of the students by clusters was determined based on the distribution of the students by gender, grade, and participation in sports.
Binary logistic regression was used to analyze the relationships between demographic factors and motor variables and HRF clusters. Nagelkerke R^2 was used to evaluate model fit, and the Hosmer–Lemeshow test was used to assess the suitability of applying logistic regression analysis.

Results

Checking the internal consistency of the HRF questionnaire on a new sample showed satisfactory characteristics (Cronbach's $\alpha = 0.79$; McDonald's $\omega = 0.80$).
Table 1 displays the students' success rate in solving the HRF questionnaire. The success rate of students achieved ranges from 16.2% to 87.8% of correct answers. The overall success rate of 40.2% is below the expected success rate of 50%. Female students performed better than male students, achieving a success rate of 41.85% compared to 38.49%. Students from the sixth grade had a higher success rate in relation to the fifth grade, 41.78% as opposed to 38.75%. The largest difference was found between students who participate in sports and those who do not, 42.24% compared to 35.1%.

Table 1. Percentage of correct answers in the HRF questionnaire by student categories

Question	Gender		Grade		Participation in sports		Total
	Male	Female	Fifth	Sixth	Yes	No	
Question 1	43.8%	53.6%	45.4%	52.4%	47.8%	50.8%	48.6%
Question 2	83.9%	90.9%	87.4%	87.4%	89.8%	81.5%	87.4%
Question 3	51.8%	55.5%	49.6%	58.3%	59.2%	40.0%	53.6%
Question 4	24.1%	33.6%	26.1%	32.0%	33.8%	16.9%	28.8%
Question 5	52.7%	40.9%	42.9%	51.5%	46.5%	47.7%	46.8%
Question 6	17.9%	14.5%	13.4%	19.4%	16.6%	15.4%	16.2%
Question 7	69.6%	73.6%	70.6%	72.8%	76.4%	60.0%	71.6%
Question 8	44.6%	30.0%	34.5%	40.8%	37.6%	36.9%	37.4%
Question 9	24.1%	25.5%	22.7%	27.2%	27.4%	18.5%	24.8%
Question 10	50.9%	49.1%	50.4%	49.5%	51.6%	46.2%	50.0%
Question 11	16.1%	17.3%	18.5%	14.6%	14.6%	21.5%	16.7%
Question 12	42.0%	48.2%	41.2%	49.5%	50.3%	32.3%	45.0%
Question 13	40.2%	60.9%	53.8%	46.6%	54.1%	41.5%	50.5%
Question 14	34.8%	44.5%	37.0%	42.7%	41.4%	35.4%	39.6%
Question 15	25.9%	30.0%	26.9%	29.1%	33.8%	13.8%	27.9%
Question 16	23.2%	40.9%	22.7%	42.7%	31.8%	32.3%	32.0%
Question 17	25.9%	30.9%	31.1%	25.2%	31.2%	21.5%	28.4%
Question 18	20.5%	21.8%	17.6%	25.2%	22.3%	18.5%	21.2%
Question 19	57.1%	66.4%	63.0%	60.2%	64.3%	55.4%	61.7%
Question 20	30.4%	50.9%	35.3%	46.6%	47.8%	23.1%	40.5%
Question 21	43.8%	24.5%	37.8%	30.1%	31.2%	41.5%	34.2%
Question 22	50.0%	57.3%	53.8%	53.4%	58.0%	43.1%	53.6%
Question 23	26.8%	25.5%	25.2%	27.2%	26.1%	26.2%	26.1%
Question 24	29.5%	26.4%	30.3%	25.2%	29.9%	23.1%	27.9%
Question 25	38.4%	36.4%	36.1%	38.8%	35.0%	43.1%	37.4%
Question 26	47.3%	49.1%	51.3%	44.7%	51.0%	41.5%	48.2%
Question 27	36.6%	50.9%	42.0%	45.6%	47.8%	33.8%	43.7%
Question 28	25.9%	22.7%	18.5%	31.1%	25.5%	21.5%	24.3%
Total	38.49%	41.85%	38.75%	41.78%	42.24%	35.11%	40.15%

The questions that were most challenging for students were questions 6, 11 and 18. The proportion of respondents who provided correct answers to these questions was less than 25%. Questions 2 and 7, which were of an extremely facile nature, were answered correctly by more than 70% of students. The students' total score on the HRF questionnaire was 11.24, and the distribution did not deviate significantly from a normal distribution (Table 2). In the male and fifth-grade categories, the distribution differs significantly from a normal distribution. No evidence of asymmetry in distribution was observed among the student categories. Female students, sixth-grade students, and students participating in sports activities exhibited superior average results in comparison to their counterparts.

Table 3 shows a comparative analysis of HRF scores categorized by gender, grade, and sports participation. The overall model showed statistically significant differences ($F(1, 214) = 3.989$, $p = .001$) with a medium effect size (Partial $\eta^2 = 0.115$). Levene's test confirmed that variances between groups are not significantly different ($p = .809$). The analyzed factors accounted for 8.6% of the variability in the HRF-score variable (Adjusted $R^2 = 0.086$). There was a medium effect size difference between students who participate in sports and those who do not (Partial $\eta^2 = 0.063$). The difference between sixth and fifth grade students is statistically significant in favor of sixth grade students, with a small effect size (Partial $\eta^2 = 0.020$). There was no statistically significant difference between students of different genders. Factor interactions did not show a statistically significant relationship with the HRF score.

Table 2. Basic descriptive statistics for HRF-score variable

Categories	*N*	Min.	Max.	Mean	*SD*	Skewness	Shapiro–Wilk
Male	112	3.00	20.00	10.78	3.53	0.295	.018
Female	110	4.00	19.00	11.72	3.20	−0.232	.142
Fifth grade	119	3.00	17.00	10.85	3.34	−0.208	.030
Sixth grade	103	4.00	20.00	11.70	3.42	0.266	.028
Participating in sports	157	4.00	20.00	11.83	3.22	0.088	.112
Not participating in sports	65	3.00	17.00	9.83	3.42	0.117	.152
Total	222	3	20	11.24	3.39	0.030	.056

Table 3. Results of three-factor analysis of variance of HRF-score

Source	Mean Square	*df*	*F*	*p*	Partial η^2
Overall model	42.028	7	3.989	.001**	0.115
Gender	30.867	1	2.930	.088	0.014
Grade	46.149	1	4.380	.038*	0.020
Participation in sports	151.064	1	14.338	.001**	0.063
Gender × Grade	14.903	1	1.415	.236	0.007
Gender × Participation in sports	14.100	1	1.338	.249	0.006
Grade × Participation in sports	0.299	1	0.028	.866	0.000
Gender × Grade × Participation in sports	11.910	1	1.130	.289	0.005

Statistical significance: *$p \leq .05$; **$p \leq .01$

For most motor variables and BMI, the data distribution exhibited a significant deviation from a normal distribution. Therefore, the relationships between the HRF score and the variables, as well as demographic factors, were analyzed using a combination of cluster analysis and binary logistic regression.

The application of two-step cluster analysis on the HRF-score identified two characteristic clusters with good measures of cohesion and separation (Silhouette measure = 0.7). The first cluster consisted of students with lower HRF scores (8.57 ± 1.83; $N = 116$; 30.6% of correct answers). The second cluster consisted of students with higher HRF scores (14.17 ± 1.91; $N = 106$; 50.6% of correct answers). The distribution of students into clusters according to gender, grade and participation in sports (Table 4) showed that, of the 106 students in the second cluster, 80.2% participated in sports and 58.6% were female. An equal proportion of students from both grades were included in the second cluster.

Table 4. Distribution of percent students in HRF clusters by gender, grade, and participation in sports

Cluster	Statistics	Gender		Grade		Participation in sports	
		Male	Female	Fifth	Sixth	Yes	No
First cluster $N = 116$	Count	68	48	65	51	72	44
	% Within clusters	58.6%	41.4%	56.0%	44.0%	62.1%	37.9%
	% Within category	60.7%	43.6%	54.6%	49.5%	45.9%	67.7%
Second cluster $N = 106$	Count	44	62	54	52	85	21
	% Within clusters	41.5%	58.5%	50.9%	49.1%	80.2%	19.8%
	% Within category	39.3%	56.4%	45.4%	50.5%	54.1%	32.3%
Total	**Total**	112	110	119	103	157	65
	% Within clusters	50.5%	49.5%	53.6%	46.4%	70.7%	29.3%

The results of the logistic regression of the HRF cluster variable (Table 5) demonstrated that the applied model was statistically significant ($\chi^2 = 32.23$; $p = .001$) with no significant difference between predicted and observed data (Hosmer-Lemeshow $p = .164$; Nagelkerke $R^2 = 0.180$). A statistically significant association was demonstrated between student participation in sports and the second cluster, which was characterized by superior results on the HRF test ($p = .014$; odds ratio = 2.39). The results of the sit-and-reach test ($p = .001$; odds ratio = 1.083) and the 30-second sit-up test ($p = .047$; odds ratio = 0.905) also demonstrated a statistically significant association with the second cluster.

Table 5. Results for logistic regression of HRF clusters variables

Variables (last referent value)	*B*	*SE*	χ^2	*p*	Exp(*B*)	95% CI for Exp(*B*)	
						Lower	Upper
Gender (female)	−0.154	0.34	0.20	.656	0.851	0.436	1.686
Grade (sixth)	−0.268	0.32	0.72	.395	0.765	0.413	1.418
Participation in sports (non)	0.873	0.36	6.03	.014*	2.393	1.192	4.802
BMI (kg/m²)	−0.073	0.05	2.48	.115	0.930	0.850	1.018
20-m shuttle run (sec.)	0.001	0.01	0.49	.481	1.001	0.998	1.004
Bent arm hang (sec.)	−0.010	0.01	0.84	.359	0.990	0.970	1.011
30 sec. sit-ups (number)	−0.100	0.050	3.94	.047*	0.905	0.820	0.999
Standing long jump (cm)	0.002	0.009	0.03	.863	1.002	0.983	1.020
Sit and reach (cm)	0.080	0.025	10.366	.001**	1.083	1.032	1.137
4 × 10 m shuttle run (sec.)	−0.199	0.146	1.857	.173	0.820	0.616	1.091

Note. *B* = unstandardized coefficient; *SE* = standard error of *B*; χ^2 = Wald statistic; Exp(*B*) = odds ratio; 95% CI = 95% confidence interval for the odds ratio; *$p \leq .05$; **$p \leq .01$.

Discussion

There are no international norms for the questionnaire, so results cannot be compared. The original HRF questionnaire administered to fifth-grade students (Hodges et al., 2016) showed that the average score for male students was 15.57 ± 3.8 and for female students 15.33 ± 4.2 correct answers. A comparison with these results shows that our students of both genders achieved lower average scores (male = 10.78; female = 11.72). The overall average percentage of correct answers on the questionnaire (40.15%) falls below the expected 50% mark. This is further corroborated by the fact that 36% of the students scored below 40% on the test. The following factors may have contributed to these results: the complexity of the questions, an inadequate grasp of specific concepts and terminology, and a paucity of targeted educational activities designed to inform students about HRF.

A comparison of the success of male and female students in this study indicated that female students were more successful, which is different from the presented study. Sixth-grade students achieved better results, with a small effect size. Such a result was to be expected, given that the older students had been exposed to information about HRF for a longer period. A significant but expected result was the large difference in performance on the HRF questionnaire between students with different levels of participation in sports.

It has been demonstrated that young students who participate in sports tend to acquire knowledge relating to fitness and physical activity at an earlier age. Furthermore, these students typically express a greater interest in such information. This assertion

is further substantiated by the findings of this study which indicate that students who engage in sports are more likely to attain superior results on the HRF questionnaire. Moreover, these studies suggest that a physically active environment is more conducive to the adoption of this form of knowledge (Zhang et al., 2014). In line with these findings, it can be hypothesized that female students are more interested in content about HRF, which may partially explain their better results on the HRF questionnaire.

Cluster analysis revealed two distinct clusters within the sample analyzed, with a good measure of cohesion and separation. The demographic profile of the clusters showed that the second cluster, had better results and comprised a high proportion of students participating in sports, particularly females. Of the 157 students who participated in sports, 85 (54.1%) were assigned to the second cluster with better results and 72 (45.9%) to the first cluster with lower results. While the first percentage is expected, the high proportion of the students in the first cluster was surprising. This finding suggests that a certain proportion of students who engage in sports may lack the expected level of understanding of health-related physical fitness, which can be attributed to their shorter duration of participation in sports activities.

Of the total number of female students, 56.4% belong to the second cluster, while 60.7% of male students belong to the first cluster. Moreover, the fact that 77.3% of female students participate in sports had a significant impact on the distribution of the sample in relation to performance on the HRF questionnaire. The distribution of students from different grades was similar in both clusters, although the first cluster contained a larger proportion of fifth-grade students with lower scores.

Conclusion

The findings of this study demonstrated that the students' performance in the HRF test was less than the expected level of 50%. This is particularly true for students who do not participate in sports activities.

Considering the findings presented and the fact that norms for the HRF questionnaire have not been developed, the first recommendation for further research is to form usable norms and enable monitoring and comparison of HRF knowledge results.

A second, practically more important recommendation is to direct greater efforts toward teaching students HRF values. This is especially important for students who do not participate in sports activities.

Further research is required to ascertain the significance and level of health-related physical fitness in the children's population (Cvejić & Ostojić, 2018; Norris et al., 2020).

Given that schools have a greater influence on physical activity and health fitness than parents or even sports clubs (Liu & Chen, 2021), it is necessary to make changes to school curricula and syllabi with content directed toward HRF (Wintle, 2022).

The limitations of this study are as follows: firstly, the lack of valid norms for the HRF questionnaire; secondly, the limited possibility of random sampling within a school setting; and thirdly, an insufficient sample size. Moreover, the utilization of a cross-sectional research design, the recruitment of participants from four schools, and the potential dependency among students selected from the same classes represent limitations that constrain the generalizability of the results.

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