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Original Investigation

The contest for movement education teachers in primary schools: issues of the written exam

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Purpose: On December 15, 2023, the written test for the first competition for teaching movement education in primary schools was held, reserved for graduates with a master's degree in Exercise and Sports Science (ESS), of which only 7% achieved a positive outcome. The aim was twofold: to measure the frequency of errors within each disciplinary field and their impact on the test result; to identify trends, relationships, and correlations among the variables to analyze and interpret the reasons for the negative outcome.
Methods: The study involved 100 sport science candidates from 15 Italian regions, recruited nationally through direct inquiries using personal contacts and social platforms. After obtaining informed consent, candidates were asked to submit their written tests, omitting identifying data. Spearman's correlation was used to analyze relationships between variables. Multiple regression was used to assess the impact of errors in each field on the final score.
Results: The biomedical area showed the strongest negative correlation with the final score, followed by the regulatory, psycho-pedagogical, ESS and English fields. The regression model predicting the final test score based on the errors in each field was statistically significant (P= .001); particularly, errors in the regulatory field seemed to have a greater impact on determining the final score.
Conclusions: The study achieved its objective by clarifying that the high rate of negative outcomes was not due to flaws attributable to the specific training of the graduates in sports sciences, as they performed well in the ESS and psycho-pedagogical sections.

Keywords: physical education; training; adequacy; Italy; Exercise and sport sciences (ESS).

Introduction

On December 15, 2023, the written test for the first competition for teaching physical education in primary schools was held, reserved for graduates with a master's degree in Exercise and Sport Sciences (ESS). Law No. 234/2022[1] introduced the teaching of movement education in primary schools, starting from the academic year 2022/23 for fifth-grade classes and from 2023/24 for fourth ones. The law states that '*In order to achieve the objectives of the National Recovery and Resilience Plan (PNRR) and to promote the adoption of behaviours and lifestyles conducive to harmonious growth, health, psychological and physical well-being, and the full development of the individual from an early age, the teaching of physical education is introduced in primary school, in the fourth and fifth grades, by teachers with appropriate qualifications and enrolment in the related teaching category 'Physical Education and Sport Sciences in Primary School'*. This responsibility has been assigned to specialized teachers [2-5] who hold a master's degree in ESS from one of the following three-degree classes: LM47 for Sports Managers, LM67 for Kinesiologists in Preventive and Adapted Physical Activity, and LM68 for Sports Kinesiologists[6]. Physical inactivity and sedentary behaviour are very common among children, as stated by the "*OKkio alla Salute*" surveillance system[7], which monitors children's lifestyles in primary school. It is estimated that one-third of children are physically inactive, and few children reach the recommended the physical activity level for their age. Moreover, children have difficulty performing even simple movements[8] such as jumping, running, throwing, catching, and maintaining balance due to a movement-restrictive environment and the use of new technologies. Sedentary children may encounter various problems, including cardiovascular diseases[9], obesity, and diabetes[10]. It is necessary to promote proper physical activity and a healthy lifestyle from the early years of kindergarten and primary school, as it is established that behaviours adopted in childhood form the basis for maintaining a healthy lifestyle in adulthood[11-12]. Children should develop a healthy and active lifestyle from an early age[13-15]. According to the World Health Organization[16], the recommended levels of physical activity for children and adolescents (5–17 years) include all activities such as games, structured exercise, physical education, sport, and travel, performed in the family, school, and community context. Together, they allow an average of 60 minutes of daily movement during the week, and moderate-to-vigorous physical activity and muscle-strengthening exercises are also recommended at least three times a week. The specialist teacher can make a significant contribution in this regard[17].
The candidates for specialized teaching roles took the computer-based written exam for the movement education competition on December 15, 2023. The exam lasted 100 minutes and consisted of fifty multiple-choice questions: 40 questions to assess the candidate's competence and knowledge, 5 questions to evaluate English competence at the B2 level of the Common European Framework of Reference for Languages, and 5 questions to

assess digital skills related to the effective use of technology and electronic multimedia devices for educational purposes[18]. Each correct answer was worth two points, while incorrect or omitted answers did not score points, with a maximum score of 100 points. Candidates had to score at least 70/100 to pass the exam. The test questions were formulated nationally by the Ministry of Education, with assistance from a national commission. The content of the test included a general section on school regulations, in addition to a disciplinary syllabus covering ESS, biomedical, and psycho-pedagogical aspects. Out of 22,586 candidates, only 7% (1,492 candidates) achieved the minimum score of 70 out of 100, thus qualifying for the oral exam. All 1,492 candidates passed the oral exam, leaving 248 positions vacant. Three months later, a similar competition for secondary school, aimed to certify general teaching skills, as well as related effective instructional design skills, including the instructional use of technology and multimedia electronic devices, was held by future physical education teachers (DDG No. 2575/2023)[19]. On 230.018 candidates, 86.03 % passed the written exam. This contradictory outcome raises the question of whether the negative result of the primary school competition was due to issues with the questions rather than the candidates' training. Analysis of the questions reveals that there were 15 questions on regulations, 12 on Exercise and Sport Sciences (ESS), 7 on psycho-pedagogy, 6 on biomedicine, 5 on digital skills, and 5 on English. Consequently, the objectives of this study were to:

- Measure the frequency of errors within each section and their impact on the test result.
- Identify trends, relationships, or correlations among the variables to evaluate why the result was very negative.

Methods

Study participants and data collection

The study involved 100 sport science candidates from 15 Italian regions, with the highest percentages from Campania (40.1%), Lombardy (15.9%), and Apulia (11.1%), who responded to the inquiry via social platforms and submitted their written tests officially. Errors made by candidates for each question were catalogued, then the number of errors relative to each section was calculated: 15 questions on regulations, 12 on ESS, 6 on biomedicine, 7 on psycho-pedagogy, 5 on English, and 5 on computer science, followed by the final score.

Statistical Analysis

Descriptive statistics were used to summarize the data in terms of frequency and percentage. The percentage of errors in each cultural area was calculated. Since each section has a different number of questions and sections with more questions may carry more weight than those with fewer questions, the scores were normalized by dividing each incorrect answer by the total number of questions in each section and multiplying the quotient by 100. Spearman's correlation was performed to detect significant relationships between the grade and the errors made in both total and relative terms. Finally, a regression analysis was conducted to understand which area had the greatest impact on the score obtained. Significance was set at P< .05. Data analyses were performed using the Statistical Package for Social Science software (IBM SPSS Statistics for Windows, version 26.0, IBM, SPSS Inc., Armonk, NY, USA).

Results

Most of candidates reached a score of 68 (16%), 66 (14%) and 60 (13%). The mean score was of 61.7 ± 7.3. Data analysis showed most errors were made in the biomedical section (M ± SD; 56.8 ± 21.7), followed by ESS (44.6 ± 9.8) and psycho-pedagogical sections (38.7 ± 18.1). A detailed description is depicted in Figure 1.

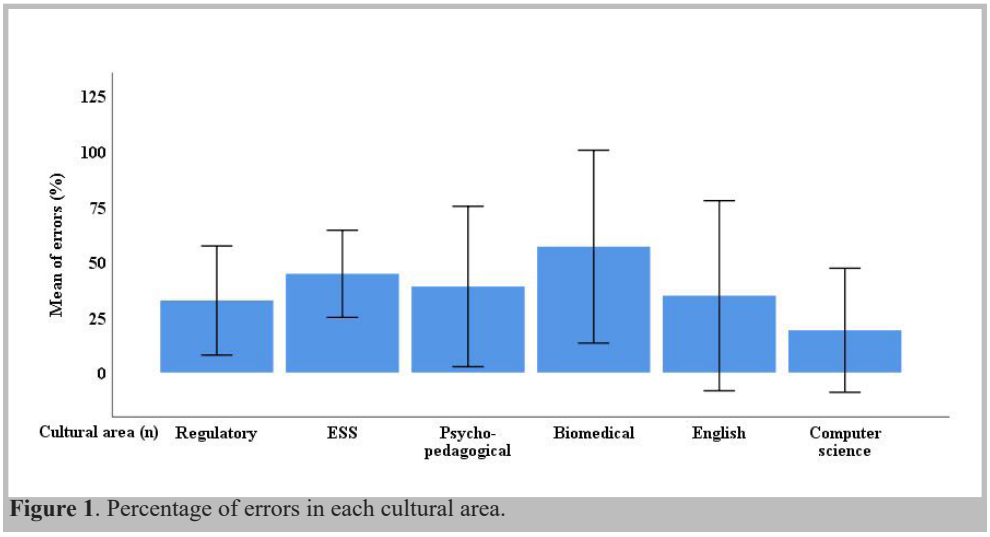

Figure 1. Percentage of errors in each cultural area.

Statistically significant correlations emerged between the final test score and the errors made in each section. The biomedical section had the strongest negative correlation (r = - .616; P = .000), followed by the regulatory (r = - .553; P = .000), psycho-pedagogical (r =- .485; P = .000), ESS (r = -.455; P = .000), and English (r = - .553; P = .000) sections. A detailed description is reported in Table 1.

Regression was used to verify the impact of errors made in each area on the test score. The regression model summary provides a detailed view of the statistical analysis conducted to predict the dependent variable (score) using different predictors. The multiple correlation coefficient (R) = .997, indicating a very strong correlation between the predictors and the dependent variable. R-square = .993, indicating that 99.3% of the variance in the dependent variable (score) is explained by the predictors in the model. The adjusted R-square is .993, suggesting that the model is well-fitted to the data. The regression model is statistically significant (P = .000). A detailed description is shown in Table 2.

From the multiple linear regression, it was found that errors

Table 1. Correlation analysis among score and errors in each cultural area.

Correlations								
		1	2	3	4	5	6	7
Rho	Score	1,000						
	Regulatory	-.553*	1.000					
	ESS	-.455*	.176	1.000				
	Psycho-pedagogical	-.485*	.101	-.022	1.000			
	Biomedical	-.616*	.184	.083	.095	1.000	.	
	English	-.553*	.038	.233	.042	.403*	1.000	
	Computer science	-.164	-.118	-.061	.138	-.043	.197	1.000

The correlation is significant "*" at the $P < .01$ level (two-tailed).

Table 2. Regression analysis.

Variables	B	SE	β	t	*P*	95% CI
Constant	100.458	.516		194.608	.000	[-12.393, -3.257]
Regulatory	-.297	.007	-.489	-42.282	.000	[- .311, - .283]
ESS	-.254	.009	-.315	-27.595	.000	[- .272, - .235]
Psycho-pedagogical	-.143	.005	-.339	-30.247	.000	[- .152, - .133]
Biomedical	-.123	.004	-.348	-28.566	.000	[- .132, - .114]
English	-.097	.004	-.278	-22.004	.000	[- .106, - .089]
Computer science	-.095	.006	-.177	-15.039	.000	[- .108, - .082]

$R^2 = .993$, Adjusted $R^2 = .993$, Std. Error of Estimate = .664

Note: B, Regression coefficient; SE, Standard error; β, Standardized regression coefficient; t, *t*-test value; P, p-value; CI, Confidence interval; ESS, Exercise and sports science; R^2, Coefficient of determination; Adjusted R^2, Adjusted coefficient of determination; F, F-test value.

committed in the legislative area had a greater impact on the overall test score than the others (- .297). To predict the mark based on the sample taken, the formula is: 100.458 – (.297 × no of regulatory errors) – (.254 × no of ESS errors) – (.143 × no of psycho-pedagogical errors) – (.123 × no of biomedical errors) – (.097 × no of English errors) - (.095 × no of computer science errors).

Discussion

The results of this study revealed several significant relationships between the errors made by candidates in various sections and their final score on the written exam. The correlation analysis showed that the biomedical section had the strongest negative correlation with the final score (r = - .616), followed by the regulatory (r = - .553), psycho-pedagogical (r = - .485), ESS (r = - .455), and English (r = - .553) sections. Therefore, each section has a corresponding weight in the statistical values determining the negative final score. The computer science section did not show a significant correlation with the final score, suggesting that these errors do not significantly affect the final score. The biomedical section, which had the strongest negative correlation, was crucial in the poor outcome, indicating that these questions had a significant impact on the test failure. This observation aligns with the non-medical or non-health profession nature of Physical Activity and Sport Sciences degree courses[20-23]. The same applies to the regulatory section, as the statistical value is close to the biomedical section and only slightly lower. It is essential to specify that ESS degree courses are not of a legal nature. The psycho-pedagogical section falls in the middle statistical values, slightly above the ESS section, and this statistical value is in line with the educational nature of the specific degree courses[24]. For the English section, the significant negative correlation with the final score suggests that errors in this section considerably influence the overall test result. This can be attributed to the difficulty candidates faced in interpreting and correctly answering questions in English, a critical aspect considering the increasing importance of language competence in an international academic and professional context. Multiple regression further explored the specific effects of errors in each section, with a high statistical value ($P < .001$), highlighting that 99.3% of the variance in the final score ($R^2 = .993$) was due to errors in different sections. This suggests that errors in various sections are strong predictors of the overall result. In other words, the model is highly reliable in the specific context of the analysed data, and thus, the predictive variables are appropriate for explaining the final score. Only 0.7% of the variability in final scores is not explained by errors in different sections. Among the examined areas, errors in the regulatory section had the most

significant impact on the final score (B = - .297), followed by errors in the ESS (B = - .254), psycho-pedagogical (B = - .143), biomedical (B = - .123), English (B = - .097), and computer science (B = - .095) sections. With a regression coefficient of - .297, errors in this section have the largest negative impact on the final score. Each error in this section decreases the score by about .297 points, indicating a strong sensitivity of the final score to regulatory errors. This further result shows that, although the biomedical section had the strongest negative correlation in isolation, it is the regulatory area that most influenced the final score when all variables are analysed together. The lower incidence of errors in the ESS and psycho-pedagogical sections highlights those candidates performed better considering the non-medical, non-health profession, and non-legal nature of ESS degree courses. Finally, the lesser negative impact of the English and computer science sections indicates a balanced performance by candidates, placing these questions in the right selection context. An additional point of reflection is the success rate of two nearly contemporaneous physical education competitions (8% eligible for primary school contest vs 86% for secondary school context), which, when discussing the data, provides stronger evidence that the negative result was not due to candidate training. This significant disparity in results raises important questions about the nature and appropriateness of the questions and response. Lastly, the fact that all candidates successfully passed the oral examination further corroborates that the questions, despite being difficult and unclear in their responses, were overcome by excellent candidates. It is crucial to emphasize the importance of this selection for the introduction of the kinesiologist role[25-27] in the context of primary school, as these professional plays a crucial role in the psychophysical and social development of children through physical education, promoting a healthy and active lifestyle.

Practical applications

The evidence from this study suggests a different distribution of questions across the different sections, with a higher number of questions for the ESS and psycho-pedagogical sections and fewer for the biomedical and normative sections. Additionally, these latter two sections should have lower difficulty and greater clarity. In the next selection of questions, it is essential to pay particular attention to the formulation to ensure it adequately reflects the preparation of sports science candidates. Future studies should broaden the analysis of tests in all regions, trying to make comparisons between candidates who passed and those who failed.

Conclusions

The study achieved its objective by dispelling the doubt that the high rate of negative outcomes was not due to the candidates' lack of knowledge, as they performed well in the ESS and psycho-pedagogical sections. The biomedical and normative sections, being less relevant to the required knowledge and skills for teaching, should be more congruent, easier, and clearer in their response options. Although the sample size was small, it was territorially representative due to the necessity of adopting an official participation formula for the research, which was required by the study type. The overwhelmingly positive results of another similar written test for the same competition and the unanimous success in the oral examination unequivocally demonstrate that the written test in this study was misaligned compared to other similar tests.

Ethical Committee approval

Ethical approval was waived for this study as it involved only the analysis of written test results and did not involve human subjects directly.

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Conflicts of interest

The authors have no conflicts of interest to declare.

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Author-s contribution

Conceptualization, G.R. and T.D.; methodology, G.R.; software, S.A.; validation, F.D. and G.R.; formal analysis, S.A.; investigation, G.R.; resources, F.D. and T.D.; data curation, S.A.; writing—original draft preparation, G.R. and S.A.; writing—review and editing, F.D. and T.D.; visualization, G.R. and T.D.; supervision, F.D.; project administration, G.R. All authors have read and agreed to the published version of the manuscript.

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