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Variación en la Autoeficacia Motriz Percibida por Alumnos Españoles a lo largo de las distintas etapas educativas

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Abstract:

Motor self-efficacy is the ability to cope with obstacles, to control them and to solve them in the best possible way. It is closely related to performance in physical education and student health. The aim of this study is to measure the performance of motor self-efficacy in Physical Education in students aged 10 to 18 years, analyzing the differences between students according to their educational level and age. A total of 946 students responded to five socio-demographic questions, in addition to the Motor Self-Efficacy Scale validated in Spanish. The Kolmogorov-Smirnov test was used to determine the assumption of normality, but since this assumption was not met, non-parametric tests were used. In this sense, the Motor Self-Efficacy Scale score and the differences between the different instructional cycles were analyzed using the Kruskal-Wallis test. In addition, a pairwise comparison was performed as part of a post hoc study to examine the differences between the different groups. The relationship between the mean scale score and the variable age was investigated using Spearman's Rho test. Subsequently, the relationship between motor self-efficacy and participants' height, weight and BMI was examined using the direct stepwise regression test. Finally, Cronbach's alpha was used to assess the reliability of the instrument. Significant statistical differences were observed between educational levels and their relationship with BMI, height and weight, highlighting the importance of motor self-efficacy at different stages. Therefore, it would be interesting to introduce educational methodologies that promote active models and improve students' motor self-efficacy.

Keywords:

Motor self-efficacy, students, educational level, physical education, healthy lifestyle

Resumen:

La autoeficacia motriz es la capacidad para hacer frente a los obstáculos, controlarlos y resolverlos de la mejor manera posible. Está estrechamente relacionada con el rendimiento en educación física y la salud de los alumnos. El objetivo de este estudio es medir el rendimiento de la autoeficacia motriz en Educación Física en alumnos de 10 a 18 años, analizando las diferencias según su nivel educativo y la edad. Un total de 946 estudiantes respondieron a cinco preguntas sociodemográficas, además de la Escala de Autoeficacia Motriz, validada en español. Se utilizó el test de Kolmogorov-Smirnov para determinar el supuesto de normalidad, pero como este supuesto no se cumplía se utilizaron pruebas no paramétricas. En este sentido, la puntuación de la autoeficacia motriz y las diferencias entre los distintos ciclos educativos se analizaron mediante la prueba de Kruskal-Wallis. Además, se realizó una comparación por pares como parte de un estudio post hoc para examinar las diferencias entre los distintos grupos. La relación entre la puntuación media de la escala y la variable edad se investigó mediante la prueba Rho de Spearman. Posteriormente la relación entre la autoeficacia motriz y la altura, el peso e IMC a través de la regresión directa por pasos. Por último, se utilizó el alfa de Cronbach para evaluar la fiabilidad del instrumento. Se observaron diferencias estadísticas significativas en diferencias estadísticas significativas entre los niveles educativos y su relación con el IMC, la altura y el peso, destacando la importancia de la autoeficacia motriz en las diferentes etapas. Por lo tanto, sería interesante introducir metodologías educativas que promuevan modelos y mejoren la autoeficacia motriz de los alumnos.

Palabras claves:

Autoeficacia motriz, estudiantes, nivel educativo, educación física, estilo de vida saludable

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1. Introduction

The relationship between self-efficacy and academic success has been investigated (Hernández-Álvarez et al., 2011). Multon et al. (1991) conducted a meta-study in which they examined 36 studies that had some form of measure that allowed comparison of particular value judgments of efficacy with measures of performance on fundamental cognitive skills in various academic domains. They arrived at a number of findings, one of which was that students with poorer academic performance had greater predictive power for perceived self-efficacy (Multon et al., 1991). Numerous investigations (Lent et al., 1994, 1997; Pajares, 1996) have pointed out that self-efficacy is not an interchangeable notion and that its predictive power varies across subjects and even across different aspects of a subject (Lent et al., 1997). Similar findings are reported by Pajares and Valiante (2002), who found that perceived efficacy decreased as pupils moved from elementary to high school. Studies in the area of physical activity (PA) have also shown that adolescents' conduct in connection to their practice of PA is influenced by their perception of its efficacy (Carroll & Loumidis, 2001; Dishman et al., 2004; Welk & Schaben, 2004). However, studies concentrating on the subjective expectation of being able to effectively handle motor situations have not been conducted in great numbers with specific tools for evaluating self-efficacy, which we could refer to as physical or motor self-efficacy (Hernández-Álvarez et al., 2011). People's perceptions of their efficacy, however, must be measured in terms of specific judgments of their ability to complete tasks defined in terms of the disciplinary domain, as stated by Bandura (1997) and Zimmerman (1996), and supported by empirical studies (Lent et al., 1994, 1997; Pajares, 1996; Pajares & Valiante, 2002).

The contributions of Bandura led to a significant advancement in the understanding of self-efficacy (Bandura, 1986, 1992, 1997). According to the author, self-efficacy is the belief that one is competent in the face of obstacles that arise in life, enabling one to approach these circumstances with the conviction that one can control them and suitably lessen the uncertainty they bring (Bandura, 1997). Self-efficacy affects the kind of activity a person engages in, becoming a sign of the amount of time and effort, he or she commits to it as well as of how well they perform. Hernández-Álvarez et al. (2011) claim that the concept of general self-efficacy serves as the foundation for the concept of motor self-efficacy, which refers to a person's sense of competence when faced with challenges requiring their use of their motor skills and their ability to solve problems, involving participation in physical activities. Insofar as it avoids doubts or conceptual conflicts with the definitions of other terms like perceived motor skill or perceived motor competence, which are connected to the physical self-concept and the concept of motor self-efficacy, on which this scale is based (Ortiz-Gómez, 2021), is coherent with the approach of our study. Batey et al. (2014) provide another definition, pointing out that self-efficacy is defined in relation to views of one's own ability to complete particular activities (motor) and to overcome obstacles that would hinder successful participation in a given task (motor). A factor that appears to have a significant impact on PA performance both within and outside of physical education (PE) classes is motor self-efficacy (Ortiz-Gómez, 2021). In addition, as researchers have already noted, motor self-efficacy takes into account a wide range of variables, including—possibly—motivational variables and past successes (Perea-Chafé et al., 2016). Perceived physical ability is included in these motor self-efficacy elements as well, as it is vital to believe that one is skilled in order to produce effective results (Ortiz-Gómez, 2021).

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Bandura (1997) contends that subjects with high self-efficacy are more likely to attempt challenging tasks. However, Hernández-Álvarez et al. (2011) contend that there are no studies on the perception of self-efficacy, extending it to the motor domain (motor self-efficacy), that compare such perception with the motor reality of the subject in question, and that allow us to know whether subjects tend to overestimate or underestimate such perception. There is currently enough information available on both the low rates of PA practiced by children and adolescents as well as the rise in the practice's abandonment during adolescence (Balaguer & Castillo, 2002; Duncan et al., 2004; Hernández-Álvarez et al., 2007; Roberts et al., 2004; Sallis et al., 2000; Velázquez et al., 2003). The perception of motor self-efficacy is a construct that needs to be examined in this context, justifying the need to build particular instruments, but it is important to improve the pertinent knowledge on the components that influence this reality (Hernández-Álvarez et al., 2011). With motor self-efficacy being a crucial factor to consider in PE sessions, where students learn motor skills, the idea of boosting students' perceptions of efficacy in teaching programs could result in significant physical, psychological, and social advantages (Ortiz-Gómez, 2021). According to Ruiz-Pérez (1995), this perception of motor efficacy is related to the subjective feelings that children have and contribute to the development of their motor actions. This perception in turn affects the choice of activities, the consistency of motor practice, and the performance of motor actions. However, it should be noted that there are fewer studies on motor self-efficacy because it is a novel study variable and that no international research has been identified on the topic (Ortiz-Gómez, 2021). Neither the lack of appropriate instruments, neither the relationship between general and particular efficacy in PA nor the latter's association with motor performance have received enough research (Hernández-Álvarez et al., 2011).

Because of the above, this study measures perceptions of motor self-efficacy when engaging in PA in students aged 10 to 18 years, analyzing the possible differences according to the educational level to which the students belong and their age.

2. Materials and Methods

2.1. Participants

The sample size was chosen using the convenience sampling approach in accordance with non-probability sampling (Salkind, 1999). It may be said that a gender-balanced sample was produced since 48.3% of the sample (n = 457) was female and 51.7% of the sample (n = 489) was male. Of the students, 19.10% were in the third cycle of primary education, which runs from ages 10 to 12, 18.40% were in the first cycle of compulsory secondary education, which runs from ages 12 to 14, 14.40% were in the second cycle of compulsory secondary education, which runs from ages 14 to 15, and 24.00% were in the baccalaureate program (from 16 to 18 years of age). Age was 14.59 years on average (SD = 2.08).

Participants had to meet the following criteria in order to be included: a) informed parental consent b) enrollment in PE in Extremadura public schools in the last cycle of primary, first or second cycle of secondary school, or baccalaureate studies. The research was carried out in compliance with the Declaration of Helsinki's ethical guidelines, and the University of Extremadura's bioethics committee gave its approval to the protocol (Registration Code 71/2022).

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2.2. Instruments

The Google Forms tool was used to create the sociodemographic characterization questionnaire, which consisted of five questions on the age, gender, educational level, province of residence, and center environment of the participants. In addition, the validated Spanish version of the Motor Self-Efficacy Scale (E-AEM) was applied in the school population to measure the degree of motor self-efficacy (Hernández-Álvarez et al., 2011). This test consists of ten items that describe potential scenarios that could arise when engaging in PA. It employs a Likert-type scale with values ranging from 1 to 4, with 1 denoting "totally disagree" and 4 denoting "totally agree." The scale's application yields a score based on the sum of all the components, with a minimum value of 10 signifying a low degree of motor self-efficacy and a maximum value of 40 signifying the highest level of self-efficacy perception. The authors reported a reliability value for Cronbach's alpha of 0.89.

2.3 Procedure

The contact information of all those who teach the final cycle of primary school (10 to 12 years), the cycle of compulsory secondary education (12 to 16 years), and high school (16 to 18 years) was selected from the directory of public schools in Extremadura provided by the Department of Education and Employment of the Regional Government of Extremadura. Informing the PE teachers of the study's subject, a model of the instrument, and the importance of informed parental agreement was done by sending emails to all the centers that had been chosen. If the teacher consented to participate in the study, it was asked that they set up a time through email for a member of the research team to visit the school and interview the children in PE, providing that all informed parental consents had been gathered. As soon as it was confirmed that the participants' parents or guardians had signed the informed consent form, a researcher went to the school and gave each student a tablet with a URL link to the questionnaire created using the Google Forms digital application. The researcher then read out each item to make sure the participants had understood the instrument. To save time and money and make it easier to store all the results in one database, it was decided to use an electronic questionnaire. The questionnaire took an average of 10 minutes to finish. The information was gathered between September and December 2022 in an anonymous manner.

2.4. Statistical Analysis

The Statistical Package for Social Sciences (SPSS) version 23.0 for MAC was used to evaluate the data that had been gathered. The assumption of normality in the distribution of the data was examined using the Kolmogorov-Smirnov test. Nonparametric tests were utilized since the results of this test showed that the assumption was false. The mean (M) and standard deviation are how descriptive data are presented (SD). The E-AEM score and differences between the several instructional cycles were analyzed using the Kruskal-Wallis test. A pairwise comparison was done as part of a post-hoc study to examine the differences between the several groups.

The link between the average scale score and the age variable was investigated using the Spearman's Rho test. The relationship between the motor self-efficacy and participants' height, weight and BMI was examined using the direct stepwise regression test. The variables could not be entered into the predictive model unless they had a significance level of less than 0.05. Cronbach's Alpha was used to evaluate the instrument's reliability. Reliability levels between 0.60 and 0.70 can be regarded

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as acceptable, whereas values between 0.70 and 0.90 can be regarded as satisfactory, according to Nunnally and Bernstein (1994).

3. Results

Table 1 shows descriptive information for the E-AEM based on the mean (M) and standard deviation (SD) for each educational level. It is observed that there are significant differences at the general level and specifically between the last cycle of primary school and the second cycle of secondary school and between the latter and high school.

TABLE 1

Descriptive analysis and differences by education stage

		Education stage				
E-AEM	**M (SD)**	**Third cycle of PrE (A)**	**First cycle of CSE (B)**	**Second cycle of CSE (C)**	**Baccalaureate (D)**	**p**
ΣE-AEM	31.41 (6.07)	32.43 (5.49)	31.50 (5.70)	30.32 (6.37)	31.87 (6.26)	p = .005** p (A-B) .832 p (A-C) .012* p (A-D) 1.000 p (B-C) .349 p (B-D) 1.000 p (C-D) .017*

Note: ΣE-AEM = Sum of scale AEM. Differences are significant at **p < .01; *p < .05. M = Mean value; SD = Standard deviation; PrE = Primary education; CSE = Compulsory secondary education. Each score obtained is based on a Likert scale (1–4): 1 "Totally disagree", 2 "Quite disagree", 3 "Quite agree", 4 "Totally agree".

Table 2 displays the correlations between E-AEM and the age by means of Spearman's Rho test. It can be seen that there are significant differences (p = < .023).

TABLE 2

Correlation between E-AEM scale items with age

Items	Age p (p)
ΣE-AEM	.023* (.475)

Note: ΣE-AEM= Sum of scale AEM. Differences are significant at *p < .05. Each dimension's score is determined using a Likert scale (1-4) = 1 "Totally disagree", 2 "Quite disagree", 3 "Quite agree", 4 "Totally agree".

Table 3 contains the regression of the E-AEM. It can be seen that in all the variables (BMI, height and weight) there are significant differences.

Table 3

Model predicting changes in motor self-efficacy

	Model 1 (R2) = 0.04			
Variable	**β**	**SE**	**t**	**p**
BMI	-1.256	0.322	-3.897	< .001**
Height	-20.188	8.385	-2.408	.016*
Weight	0.409	0.121	3.373	< .001**
Constant	67.541	13.537	4.989	< .001**

Note: Differences are significant at **p < 0.01; *p < 0.05. Each dimension's score is determined using a Likert scale (1-4) = 1 "Totally disagree", 2 "Quite disagree", 3 "Quite agree", 4 "Totally agree".

The model (perceived motor self-efficacy scores = 0.409 x Weight – 1.256 x BMI – 20.188 x Height) predicted 4% of the variability observed in the E-AEM. Participants with higher weight, lower BMI and shorter height have better E-AEM scores ($p < .05$).

Lastly, reliability was assessed using the Cronbach's alpha coefficient. According to Nunnally and Bernstein (1994), the value of .90 achieved can be regarded as satisfactory.

4. Discussion

This study arose from an interest in analyzing motor self-efficacy in students between the ages of 10 and 18 years. To achieve these results, the educational levels of the students were examined using the E-AEM. Age was also considered as an influential factor.

Firstly, with regard to the E-AEM, there are significant differences according to educational level. They can be observed especially in the last cycle of primary school (10-12 years) and the second cycle of secondary education (14-15 years) and in the second cycle of secondary school and high school (16-18 years). The literature has found that as age increases, motor self-efficacy decreases (Hernández-Álvarez et al., 2011; Ortiz-Gómez, 2021) attributed in part to decreased physical abilities to complete a motor activity (García-Cantó et al., 2013) and the accumulation of mistakes, as well as the growth of one's own critical evaluations (Causgrove-Dunn & Watkinson, 1994). In both genders, a steady decline in motor self-efficacy is observed from adolescence onwards (Perea-Chafé et al., 2016; Velázquez-Buendía et al., 2015), but especially in girls (Baños et al., 2018; Cardon & De Bourdeaudhuij, 2008; Ortiz-Gómez, 2021; Perea-Chafé et al., 2016; Timo et al., 2016; Wu et al., 2003). However, in the present research, it is found that it decreases until the second cycle of secondary school, since in high school there is an upturn in which motor self-efficacy rises again. This may be due to the fact that good motor self-efficacy favors the regular practice of PA in adolescents, as highlighted in the study by Hernández et al. (2008). In this lin n at the national and international levels with teenagers from Brazil and Spain who were between the ages of twelve and seventeen. When Brazilian and Spanish school populations were compared, it was shown that the overall scores in the Spanish population were much higher than in the Brazilian population, classifying both populations as having poor motor self-efficacy (Velázquez-Buendía et al., 2015). Furthermore, in our study, the E-AEM and the age of the students had a significant correlation. Regarding age, a significant

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progressive decline in motor self-efficacy scores was seen in Spanish adolescents in the twelve-to-fourteen-year-old and fourteen-to-fifteen-year-old age brackets, as well as between fourteen-to-fifteen and sixteen-to-seventeen-year-old age brackets (Velázquez-Buendía et al., 2015). However, this trend was not seen in Brazilian adolescents, despite the latter group's significant differences in the various age brackets (Velázquez-Buendía et al., 2015).

On the other hand, the regression model also confirms the influence of height, weight and BMI on motor self-efficacy. The literature indicate that teenagers' better motor ability predicts their larger involvement in sports and PA, but there are also other indicators that appear to foretell future PA, such as body weight and BMI, among others (Oñate-Navarrete et al., 2021). Self-efficacy has been connected to good habits like controlling weight (Silva et al., 2018), being those who possess this ability more dynamic and engaging in PA, which benefits their health (Fraile-García et al., 2019). According to Hulteen et al. (2018) 's findings, teenage motor performance is significantly influenced by body weight. As a result, sedentary behavior declines, cardiometabolic risk is reduced, physical fitness is improved, and academic performance, flexibility, self-esteem, and cognitive development are all enhanced (Bardid et al., 2019; Lopes et al., 2019; Urrutia-Gutierrez et al., 2020). In this sense, the body fat percentage, chance of being overweight, tendency toward physical inactivity, and levels of PA and fitness are all exponentially increasing in these teenagers with poor motor competence and skill (Greier & Drenowatz, 2018; Hands et al., 2019). It has been discovered that the acquisition of motor abilities, has a favorable impact on PA levels in later years, together with maintaining a healthy body weight as an adult (Martin et al., 2021; Utesch et al., 2019). The acquisition of a healthy lifestyle through the enjoyable performance of PA, as well as the actions taken during childhood and youth, will therefore have an impact on the maintenance of these habits in the stages that follow puberty (Garcia-Marin & Fernández-López, 2020; Martin et al., 2021). In the association between BMI and motor self-efficacy, statistically significant differences were found; although, regardless of BMI, students have a high capacity for physical exercise and many of them participate in extracurricular sports. (Ahumada-Satoba & Flórez-Flórez, 2019). In another study, the findings revealed a significant correlation between BMI and enjoyment, perceived self-efficacy (Carissimi et al., 2017), and motor performance (Colella et al., 2020). In other words, the findings show the importance of children's perceived self-efficacy and enjoyment in promoting motor development and an active lifestyle (Colella et al., 2020). The indirect impact of psychological correlates on physical performance and motor skills in relation to BMI was quite considerable (Colella et al., 2020; Manley et al., 2014). Regardless of age, higher values of the body mass index have been linked to a deterioration in physical efficiency (Colella et al., 2020). In addition, the findings showed that when compared to children of healthy weight, children who were overweight or obese had worse mood scores (Nagy et al., 2017). A person who is overweight or obese may have a self-perception of obesity that causes him or her to feel unfit to engage in physical exercise, which could account for the increase in BMI and drop in physical self-efficacy score (Carissimi et al., 2017). Consequently, it should be noted that there is no literature on height in relation to motor self-efficacy; however, as it is part of BMI (Engin, 2017), this variable will be taken into account in the previous paragraphs when discussing BMI.

In addition to the above, it's vital to remember that research indicates that a number of morbidities start developing in adolescence (Werneck et al., 2020). Adopting and maintaining an active lifestyle

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are among the protective factors; hence, the present issue is to successfully encourage physical exercise during the first 20 years of life (Werneck et al., 2020).

4.1. Limitations and future lines of research

The present work, like other studies, has several limitations. First, the sociodemographic, educational level, weight and height of the students may have influenced the results. Second, since the sample was chosen randomly, caution should be exercised in presenting the results. Finally, it is important to highlight the lack of previous studies evaluating the association between student height and motor self-efficacy. Some of the future lines of research would be to extend the sample to a national level in all educational stages, to examine whether age has an influence, since there are some studies that highlight that from primary education onwards motor self-efficacy decreases, however, in high school it increases again, therefore, it would be important to know whether they have carried out PA throughout their lives and hence this rebound or whether it is due to other factors. In addition, it would also be advisable to differentiate perceived motor self-efficacy according to the gender of the students. To this end, it is necessary to reach a consensus with other researchers from different regions to collect all the necessary data. Furthermore, it should be borne in mind that the role played by the entire community (family, friends and school) is very important, since it is vital to develop new preventive health policies that can make them more motivated to continue practicing sports throughout their lives and to be aware of all the benefits it can offer them as well as the disadvantages of physical inactivity.

4.2. Practical Implications

Motor self-efficacy is closely related to students' performance in Physical Education and health and unfortunately, as age increases, motor self-efficacy decreases. For this reason, the role of teachers is important, as they are one of the educational agents who can most influence pupils' perception of PA. It is also essential to work collaboratively and cooperatively with parents, as well as the involvement of all administrations in order to achieve all the benefits offered by this practice. To this end, it would be interesting to introduce educational methodologies that promote active models and improve pupils' motor self-efficacy.

5. Conclusions

This study highlights that the E-AEM, depending on the educational level and age of the student, can yield important and satisfactory results. It is also associated with variables such as BMI, weight and height. Therefore, more research should be done and new educational methodologies should be taught in order for students to have healthy lifestyle habits and improve their self-efficacy. However, it should not be forgotten that it is important to know the motivations that students have to inculcate these habits in a playful way and that learning is above all intrinsic so that they can practice them not only in their youth but also in adulthood and old age. The role of teachers is important here, as they are one of the educational agents that can most influence the students' perception of PA. It is also essential to work collaboratively and cooperatively with parents, as well as to involve all governments to achieve all the benefits offered by this practice.

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6. Author Contributions

Conceptualization, C.G.-A. and I.P.C.; Data curation, J.R.-R.; Formal analysis, S.G.-P., A.C.-P. and J.R.-R.; Funding acquisition, A.C.-P.; Investigation, C.G.-A., I.P.-C. and J.R.-R.; Methodology, I.P.C. and S.G.-P.; Project administration, C.G.-A. and J.R.-R.; Resources, A.C.-P.; Software, S.G.-P.; Supervision, A.C.-P. and J.R.-R.; Validation, S.G.-P.; Writing – original draft, C.G.-A., I.P.-C. and S.G.-P.; Writing – review & editing, C.G.-A., A.C.-P. and J.R.-R.. All authors have read and agreed to the published version of the manuscript.

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8. Institutional Review Board Statement

The research was carried out in compliance with the Declaration of Helsinki's ethical guidelines, and the University of Extremadura's bioethics committee gave its approval to the protocol (Registration Code 71/2022)

9. Informed Consent Statement

Informed consent was obtained from all subjects involved in the study.

10. Data Availability Statement

The datasets used during the current study are available from the corresponding author on reasonable request.

11. Acknowledgments

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12. Conflicts of Interest

The authors declare no conflict of interest.

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