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Analysis of the application of indicators for the comprehensive evaluation of learning in the subject Athletics

*Análisis de la aplicación de indicadores para la evaluación integral del aprendizaje en la
asignatura Atletismo*

*Análise da aplicação de indicadores para a avaliação abrangente da aprendizagem na
disciplina de Atletismo*

Niurka Luzón Cabrera^{1*} , Martha Bárbara Iznaola Cuscó¹ ,
María Antonieta Laza Rodríguez¹ , Annia Gómez Valdés² 

¹"Manuel Fajardo" University of Physical Culture and Sports Sciences. Havana Cuba.

²University of Pinar del Río "Hermanos Saíz Montes de Oca". Pinar del Río, Cuba.

*Corresponding author: luzonniurka85@gmail.com

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ABSTRACT

The evaluation system for the subject of Athletics at the "Manuel Fajardo" University of Physical Culture and Sports Sciences requires a change in its procedure, based on the use of indicators that show the transformations that have comprehensively occurred in the students' learning, mainly in practical classes, according to the new professional training model proposed by the Ministry of Higher Education (MES). The objective was to analyze the results obtained with the application of the indicators for the comprehensive evaluation of student learning in the practical classes of the Athletics subject, an instrument valued through expert criteria and that offers a structure composed of dimensions of knowledge (cognitive, procedural and axiological), indicators, parameters, measurement criteria that allow not only the comprehensive evaluation of student learning but also enable evaluation by each dimension. Theoretical and empirical methods were used, mainly synthetic analysis, experiment, expert judgment and structured observation, as well as descriptive and inferential statistical processing techniques. The analysis of the results of the learning evaluation in the practical classes with a productive orientation in the Athletics subject of the D-15 group was carried out qualitatively and quantitatively and the applied indicators were taken into account, which made it possible to demonstrate the improvement of the students in the learning variable in all its dimensions and in a comprehensive manner, which guarantees that through co-evaluation they reach logical criteria about their knowledge.

Keywords: dimensions, learning evaluation, indicators, parameters.

RESUMEN

El sistema de evaluación de la asignatura de Atletismo en la Universidad de Ciencias de la Cultura Física y el Deporte "Manuel Fajardo" precisa de un cambio en su proceder, a partir del uso de indicadores que evidencien las transformaciones ocurridas en el aprendizaje de los estudiantes de forma integral, principalmente en las clases prácticas, según el nuevo modelo de formación del profesional propuesto por el Ministerio de Educación Superior (MES). El objetivo consistió en analizar los resultados que se obtienen con la aplicación de



los indicadores para la evaluación integral del aprendizaje de los estudiantes en las clases prácticas de la asignatura Atletismo, instrumento valorado a través del criterio de experto y que ofrece una estructura compuesta por dimensiones del conocimiento (cognitiva, procedimental y axiológica), indicadores, parámetros, criterios de medidas que permiten, no solo la evaluación integral del aprendizaje de los estudiantes sino, que posibilita la evaluación por cada dimensión. Se emplearon métodos teóricos y empíricos, fundamentalmente el analítico sintético, experimento, criterio de experto y la observación estructurada, así como técnicas de procesamiento estadístico descriptivas e inferenciales. El análisis de los resultados de la evaluación del aprendizaje en las clases prácticas con orientación productiva en la asignatura Atletismo del grupo D-15 se realizó cualitativa y cuantitativamente y se tuvieron en cuenta los indicadores aplicados, lo que permitió evidenciar la mejoría de los estudiantes en la variable aprendizaje en todas sus dimensiones y de manera integral, lo que garantiza que a través de la coevaluación lleguen a criterios lógicos sobre su conocimiento.

Palabras clave: dimensiones, evaluación del aprendizaje, indicadores, parámetros.

RESUMO

O sistema de avaliação da disciplina de Atletismo da Universidade de Cultura Física e Ciências do Desporto “Manuel Fajardo” exige uma mudança no seu procedimento, baseada na utilização de indicadores que evidenciem as transformações ocorridas na aprendizagem dos alunos. nas aulas práticas, de acordo com o novo modelo de formação profissional proposto pelo Ministério do Ensino Superior (MES). O objetivo foi analisar os resultados obtidos com a aplicação dos indicadores para avaliação integral da aprendizagem dos alunos nas aulas práticas da disciplina de Atletismo, instrumento valorizado por critérios de especialistas e que oferece uma estrutura composta por dimensões de conhecimento (cognitivas, processuais e axiológico), indicadores, parâmetros, critérios de medição que permitem não só a avaliação abrangente da aprendizagem dos alunos, mas também permitem a avaliação por cada dimensão. Foram utilizados métodos teóricos e empíricos, principalmente análise sintética, experimento, julgamento de especialistas e observação



estructurada, além de técnicas de processamento estatístico descritivo e inferencial. A análise dos resultados da avaliação da aprendizagem nas aulas práticas com orientação produtiva na disciplina de Atletismo do grupo D-15 foi realizada de forma qualitativa e quantitativa e foram tidos em conta os indicadores aplicados, o que permitiu demonstrar a melhoria dos alunos na variável de aprendizagem em todas as suas dimensões e de forma abrangente, o que garante que através da coavaliação eles atinjam critérios lógicos sobre seus conhecimentos.

Palavras-chave: dimensões, avaliação da aprendizagem, indicadores, parâmetros.

INTRODUCTION

In the aspirations of the new university, it is found that each institution is characterized by the formation of values and by the assurance of the quality of its substantive processes, in order to achieve a graduate who possesses personal qualities, culture and professional skills. These elements must be taught in such a way that they allow the student to perform with social responsibility, and that promote their education for life, based on a teaching-learning process (PEA in Spanish) with developmental characteristics. In this process, evaluation becomes a mediating component and facilitates the expression of the changes that have occurred in learning based on indicators (Castellanos *et al.* 2002).

Authors such as Alcaraz *et al.* (2012), Alonzo (2018), Bakhtiar *et al.* (2018), Delgado *et al.* (2018), González (2017) and Luzón *et al.* (2022) have addressed the impact that comprehensive evaluation has to demonstrate the transformations that have occurred in learning. In this context, students are active agents during the PEA and are generally interested in knowing how to think, act and create from what they know, their ability to organize themselves to know more.

Also, they are interested in acquiring the ability to be aware of what they do not know (Lago, 2019); for this, it is necessary that the teacher in Higher Education introduces changes in the methodological procedure. This phenomenon occurs under the leadership of the PEA where it is necessary to modify the evaluation instruments and, through them, facilitate students



to develop the ability to construct independent judgments. In all this, awareness emerges about what their capabilities and limitations are as people and future professionals, through feedback (Salinas and Carolina, 2007).

According to Gutiérrez *et al.* (2018), the formative function of learning evaluation should be seen "(...) as the feedback process between all educational agents, without being associated with a grade, and with the aim of improving (...) student learning". (p.223)

From this perspective, it could be seen that during the critical review of the analytical program of the Athletics subject belonging to Study Plan E, of the "Manuel Fajardo" University of Physical Culture and Sports Sciences, a methodological weakness was detected aimed at the use of indicators and parameters that allow the comprehensive evaluation of the student. This situation limits compliance with what is oriented in Study Plan E, which highlights that the evaluation must be focused on the transformations that occurred in the student's learning during the PEA. This evaluation is focused on the use of procedural indicators that allow these transformations to be expressed in a comprehensive way.

This situation generated the need to apply indicators for the comprehensive evaluation of student learning during the practical classes of the Athletics subject as a way to improve the subject's evaluation system. Therefore, the objective of the research is to analyze the results of the learning evaluation in the practical classes with productive orientation (CPOP in Spanish), in the Athletics subject of the D-15 group of "Manuel Fajardo" University of Physical Culture and Sports Sciences.

MATERIALS AND METHODS

The research, with a quantitative approach, was carried out in the context of the Athletics subject that belongs to the first-year curriculum of the regular daytime course of the Bachelor's Degree in Physical Culture. The population was taken as 150 students enrolled in five groups that belong to Faculty One. As a sample, 30 students enrolled in the D-15



group were considered, composed of 20 males and 10 females with an age between 18 and 20 years.

As an evaluation instrument, the indicators were used to evaluate learning in the CPOP, which were evaluated theoretically, through the expert criterion method.

During the theoretical assessment, the experts expressed their criteria on the following aspects:

1. Structure and determination of the proposed indicators.
2. Systemic nature of the indicators aimed at achieving the comprehensive evaluation of students.
3. Relevance of the organization of indicators aimed at achieving the comprehensive evaluation of students.
4. Criteria on the proposed indicators
5. Possibilities of implementation in practical classes of different sports.
6. Novelty of the indicator proposal
7. Practical usefulness of the proposed indicators.

After two rounds of evaluation, as a result of determining the Kendall coefficient of agreement, there is a consensus in the experts' criteria since the value obtained is 0.244, therefore, the hypothesis of casual agreement is rejected. Besides, other descriptive measures were determined such as mode, minimum, quartile 1, median, quartile 3 and maximum in which it is confirmed that all indicators were evaluated between very adequate and quite adequate.

The indicators were applied at four times over the course of 11 weeks. The first evaluation was carried out in week three (pretest) to complete the flat racing discipline and the last in week 11 (posttest) to complete the long jump. These were carried out with the purpose of assessing the behavior of the learning variable in each dimension of knowledge according



to each indicator, based on its corresponding parameters and measurement criteria, which allow for a comprehensive evaluation.

In the case of the cognitive dimension, the construction of new knowledge was used as an indicator. Its parameters focused on the students' mastery of the qualitative and quantitative methodology used in the evaluation of the technique of the discipline under study; as well as the procedure to measure effectiveness; Furthermore, in their ability to apply procedural logic in the evaluation.

In the procedural dimension, four indicators were taken into account:

1. Organization of the activity: through it, the student properly organizes the activity and has the necessary means to collect the information
2. Observation and identification of technical indicators: moment in which the student observes the technique adequately and identifies the greatest number of indicators from the same technical execution.
3. Technical demonstration: during this, the student executes the sports motor skill technique with a polished or semi-polished level of development and in this way meets the demands of the activity.
4. Assessment and issuance of evaluative criteria: according to these, it will be considered whether the students gather all the required information through observation, whether qualitative and quantitative judgments are made based on the observed indicators and the most affected are identified. It is also perceived if the student correctly calculates the percentage of effectiveness and if he writes a report of the activity by giving reasons that reaffirm the reason for the judgment given as a product of observation, that is, if he detects and corrects the most common errors.

The indicators in the axiological dimension are: the reliability of the information obtained and the cooperative performance of the students in each of the roles. In the first case, the parameter was considered whether the student is honest with the information issued about the work done by his classmates. In the second indicator, the objective way of



communicating with your team was assessed, the cooperation with the objective from each of your roles and the aspects that allow you to exercise criticism that favors the improvement of the actions of the colleagues who make up the team.

Regarding the measurement criterion, to evaluate the cognitive dimension, it is focused on the effectiveness with which the parameters for each indicator are met, in the procedural one if the actions were executed in logical order and if the skill set in the objective was achieved which in this case is evaluating (by the students). Already in the axiological dimension, the focus was aimed at whether or not the students' interventions helped to achieve the team's objective. When granting the integrative evaluation, the model adapted for the practical class example Integrity and cellular dynamism was taken into account.

For the application of the indicators, the class activities were carried out in teams (never individually), where each team member was assigned a role (observer, executor, scorer, starter). Once the technical demonstration was done, they changed roles until all the students had gone through all the rolls. This form of work allowed the student to develop several professional pedagogical skills that are needed once they graduate from the degree from the same activity.

Once the indicators of the technique performed by his partner were identified, they were quantitatively assessed to take it to a qualitative scale where they found the percentage of technical effectiveness based on the evaluations of excellent and good. By teams, the most affected indicator is determined, the most common fundamental errors, possible causes and consequences, the task of the teaching methodology to which these errors are associated and with what means they can be solved.

This information was exchanged during the class analysis to verify the successes and failures during the activity in which students evaluate themselves and qualitatively evaluate their classmates. By writing a report that students must complete and submit in no more than seven days, the teacher verifies the positive and negative aspects observed during class. To collect the information, the teacher used a protocol (see Annex 1 and 2) intended for this type of class, where the criteria for each indicator are expressed, based on the parameters and measurement criteria. It was necessary to note that to obtain the integrative



evaluation, the teacher considered the student's performance from the beginning of the class until the report was delivered, the evaluation was awarded for each dimension and they were taken into account for the integrative evaluation. In this way, the teacher knows in which indicators the students had deficiencies and in this regard with them, as a means of feedback on the contents.

RESULTS AND DISCUSSION

In the D-15 group of 30 students that make up the group's enrollment, 29 completed the evaluations. The analysis of the application of the indicators was carried out by dimensions of knowledge as previously stated from each indicator with its parameters (Table 1).

Table 1. - Empirical frequency distribution in the cognitive dimension

	Poor	%	Average	%	Good	%	Excellent	%
Pretest	7	24.14	3	10.34	1	3.45	18	62.07
Posttest	2	6.90	3	10.34	8	27.59	16	55.17

In table 1, corresponding to the empirical frequency distribution of the evaluation results in the cognitive dimension, it can be seen how 19 students predominate with evaluations of good and excellent, which represents 65.5 % of those presented, since they meet the quality parameters related to the construction of new knowledge indicator. That is, students master the qualitative and quantitative methodology of evaluating the racing technique, as well as the procedure to measure the effectiveness of the activity; which contributes to being able to apply procedural logic to achieve the technical evaluation of flat races. As for the rest, seven do not meet any parameter and three meet only the first two.

Already in the post-test there is a decrease in the number of students with difficulty in this indicator, that is, only five achieve evaluations of poor and average and those who achieve evaluations of good and excellent increase to 24. In general, it can be stated that in this dimension there is a tendency towards normalization of the distribution of the data and an



increase in results at higher qualitative levels, which is confirmed with the results of the mode (five in both evaluations) and the average, where there was a slight shift from 4.034 in the pretest to 4.310 in the posttest, and an improvement was seen in the learning variable.

In Table 2, corresponding to the empirical frequency distribution of the evaluation results in the procedural dimension, it can be observed in the pretest that 19 students, representing 65.5%, achieved poor and fair evaluations (Table 2).

Table 2. - Empirical frequency distribution in the procedural dimension

	Poor	%	Average	%	Good	%	Excellent	%
Pretest	9	31.03	10	34.48	9	31.03	1	3.45
Posttest	1	3.45	13	44.83	6	20.69	9	31.03

Specifically, 31.03 % were not able to carry out the actions in logical order and as a consequence they were unable to evaluate their colleagues and 34.48 % presented difficulties in organizing the activity, as it was not executed with the necessary fluidity. In this sense, they stood very close to observe their partner's technical demonstration; this last indicator was the most affected in this dimension, since 82.7 % of the students executed the running technique at a gross level of development and did not meet the requirements for the activity.

Although the necessary information was collected, 62 % of the students were unable to identify the indicator for the most affected technical execution according to the situation given in the activity, the most common errors detected did not correspond to these indicators and 24.1 % did not calculate the percent effectiveness appropriately. On the contrary, ten students representing 34.48% were evaluated as good and excellent, since they executed all the actions and achieved a corresponding evaluation in more than one case or in all cases.



In the post-test, only one student failed and the number of average and excellent students increased, which shows a tendency towards normalization of the data distribution and an increase in results at higher qualitative levels, which is confirmed by the results of the mode (three in both evaluations) and the average where there was a slight shift from 3.068 in the pretest to 3.793 in the posttest, which shows an improvement in the learning variable.

In table 3, corresponding to the empirical frequency distribution of the evaluation results in the attitudinal dimension, it can be seen in the pretest that 11 students, representing 37.9 % of those presented to the activity, achieved evaluations of poor and average. In turn, ten of them do not meet the reliability indicator of the information obtained, being dishonest during its processing and benefiting their colleagues with the evaluations given (Table 3).

Table 3. - Empirical frequency distribution in the attitudinal dimension

	Poor	%	Average	%	Good	%	Excellent	%
Pretest	10	34.48	1	3.45	10	34.48	8	27.59
Posttest	1	3.45	3	10.34	13	44.83	12	41.38

Furthermore, they fail to cooperate with the objective of their group from each of their roles. The communication was not very objective, as was the criticism to achieve improvement in the actions of colleagues. Therefore, it is proposed that ten of the students expressed an indifferent attitude towards achieving the team's objective and in one, their interventions were not sufficient to achieve the goal of the activity. Ten achieved good evaluations because their interventions, although not always objective, sometimes helped to achieve the team's purpose and eight obtained excellent because their interventions always helped to achieve the planned goal.

In the post-test, there is only one student evaluated as poor and three as average, so a predominance of good and excellent evaluations is evident in 25 students that represent 86.2%. In this way, it could be observed that in the attitudinal dimension there is also a tendency towards the normalization of the distribution of the data and the increase in results at the higher qualitative levels, which is confirmed with the results of the mode (four in both



evaluations) and the average. This shows a slight shift from 3,551 in the pretest to 4,241 in the posttest; therefore, a greater modification is evident in the learning variable, within the three dimensions of knowledge.

Table 4, corresponding to the empirical frequency distribution of the integrative evaluation results, shows the comprehensive results of the students in the pretest and posttest according to the three dimensions of knowledge (Table 4).

Table 4. - Empirical frequency distribution of integrative evaluation

	Poor	%	Average	%	Good	%	Excellent	%
Pretest	9	31.03	2	6.90	12	41.38	6	20.69
Posttest	0	0.00	7	24.14	14	48.28	8	27.59

In the pretest, although there are 18 students evaluated as good and excellent, 11 are evaluated as poor and average, that is, the results are distributed among all evaluation categories.

In contrast, in the post-test there are no failed students and a predominance of students with good and excellent evaluations is evident (22), which represents 75.8 %, which is confirmed in the results of the mode (four in both tests) and the average (pretest 3,517 and posttest 4,034).

The integrative evaluation corroborates the need to establish practical classes with a productive orientation. In it, the work of teachers must be oriented towards the contextualization of the situations to be resolved when students graduate, so that they can orient their activity not only to teaching, but also to provide the scenario to identify new research facts. If this style of work can be introduced authentically in the researcher apprentice, it translates into a series of intentions, commitments and personal actions that he carries out during his productive life, regardless of where he works (Becerra-Ramírez *et al.*, 2021).



In general sense, the instrument applied in the CPOP allows the evaluation of learning based on indicators, which reflect the progress from one stage to another in the appropriation and construction of new knowledge, from its characteristics and the level of knowledge complexity. In this way, they make it possible to guide and regulate learning, as well as measure the execution of relevant actions for the appropriation of knowledge, as proposed by Lago (2017). The absence of a representative sample of the year and the rest of the groups that received Athletics classes remained as a limitation, based on a more detailed analysis of the population.

Regarding the comprehensive evaluation obtained, it contemplates the dimensions of knowledge proposed by Lago *et al.* (2017) those that correspond to the three-dimensionality of the content didactic category, the cognitive dimension that covers the knowledge system (knowledge), the procedural dimension that includes the system of skills (know-how) and the axiological dimension that contemplates the value system (knowing how to be).

This type of classes with developmental characteristics, allows with the participation of students in the evaluation through co-evaluation and self-evaluation, to the extent that they receive the new knowledge, they exercise and learn to teach, based on the interrelation of professional pedagogical skills, which constitute the main indicators (Lago, 2019) in the evaluation instrument.

This is a way to "(...) promote an adequate mastery of the modes of action that characterize professional activity and, at the same time, the development of values that ensure the formation of a comprehensive professional, suitable for future performance in society." (Roman, *et al.*, 2020, p.4).

In this way, the transformations in the student's learning are evident, which contributes to promoting their integral development, the progressive transition from dependence to independence and self-regulation is enhanced, as well as the development in the subject of the ability to know, creatively control and transform their own person and their environment (Castellanos, 2002), which is part of the integration of all the components that the professional needs, a result that retains some level of correspondence with the findings of Mola and Gastón (2020) and that can be treated from the CPOP.



CONCLUSIONS

The indicators that were applied for the evaluation of learning in the D-15 group were theoretically evaluated through the criteria of experts, which were evaluated as very adequate and quite adequate and in which the systemic nature among all its components that contribute stands out to achieve a comprehensive evaluation of students; furthermore, it highlights the novelty of the proposal for its application in the practical classes of the Athletics subject.

The result of the empirical distribution of frequencies showed a tendency towards normalization of the data distribution and an increase in results at the higher qualitative levels in the three dimensions of knowledge; which contributes to the fact that, in the comprehensive evaluation of students, a predominance of good and excellent evaluations is evident (Table 5 and Table 6).

Table 5. - Annex 1 - Indicators for the class Practice with productive orientation skill: Evaluate

VARIABLE	DIMENSION	INDICATOR	PARAMETER	MEASUREMENT CRITERIA	INTEGRATIVE EVALUATION
Learning Assessment	Cognitive	Construction of new knowledge	- The student masters the quantitative and qualitative methodology of evaluation of the technique of the discipline studied. - Masters the procedure to measure the effectiveness of the activity. - The student is able to apply procedural logic to achieve the technical evaluation of the discipline studied	If he meets the three parameters with quality (5) If he meets limitations with the three parameters (4) If he only meets parameters one and two (3) If he does not meet any of the parameters (2)	5: He reaches 5 in all three dimensions or in 2 of them, with 4 in the third. 4: He reaches evaluations between 4 and 5 in the three dimensions or in two of them, with 3 in the third. 3: He passes at least 2 of the 3 dimensions
	Procedural	Organization of the activity	-The student properly organizes the	If he executes all actions and apply them in logical	2:





	activity (correct positioning of the executor and the observer)	order, achieving a corresponding evaluation in all cases (5)	He Does not approve 2 dimensions
	-It has the necessary means to collect the data	If he executes all actions and achieve a corresponding evaluation with some error (4)	
Observation and identification of indicators for technical execution	-The student observes the technique performed by his partner appropriately. -Manages to identify more than one indicator within the sports motor skill performed by one of the team members.	If he executes some actions and achieve a non-corresponding evaluation in more than one case (3)	If he is not able to execute the actions (2)
Technical demonstration	-The student manages to execute the technique of the discipline studied with a good level of development (polished and semi-polished) -Achieves, based on its demonstration, to comply with the demands of the activity		
Assessment and issuance of evaluative criteria	-The student achieves the collection of all the required information by observing the indicators. -The student makes evaluative judgments based on the		





		observed indicators (quantitative and qualitative) and identifies the most affected, -Calculates the percent effectiveness appropriately, -Writes a report on the activity giving reasons that reaffirm the reason for the judgment given as a result of the observation made (detects and corrects the most common errors)	
Axiological	Reliability of the information obtained	-The student is honest with the information issued about the work done by his classmates	If the student's interventions always help to achieve the team's objective (5)
	Cooperative action in each of the roles (<i>executor and observer</i>)	-The student manages to communicate objectively with his team, -Manages to cooperate with the team's objective from each of their roles -Manages to exercise criticism that contributes to the improvement of the actions of the colleagues who make up the team.	If the student's interventions do not always help achieve the team's objective (4) If the student's interventions are not sufficient to achieve the team's objective (3) If he shows an indifferent attitude towards achieving the team's objective (2)





Table 6. - Annex 2. - Protocol for data collection in the evaluation of learning in the CPOP

No.	Name and surname	Cognitive Dimension			CM	Procedural Dimension													CM	Axiological Dimension				EI					
		CNC				O.A.	IIO			DT	VEC			TRUST	A.C.														
		1	2	3			4	5	6		7	8	9		10	eleven	12	13		14	fifteen	16	17						

Legend

- CNC: Construction of new knowledge
- DT: Technical demonstration
- AC: Cooperative performance in each of the roles
- OA: Organization of the activity
- VEC: Assessment and mission of evaluative criteria
- CM: Measurement criterion in each dimension
- OIIT: Observation and identification of technical indicators.
- IO: Reliability of the information obtained.
- EI: Integrative evaluation

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Authors' contribution:

The authors have participated in the writing of the work and analysis of the documents





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Antonieta Laza Rodríguez, Annia Gómez Valdés

