

INTEGRAL ASSESSMENT OF PHYSICAL EDUCATION IN PRIMARY SCHOOL

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ABSTRACT

To determine the motor, cognitive, affective and social skills, an integral assessment model of the physical education class of 1st to 6th grade primary school students was implemented to obtain reference data by school level and gender. Physical education classes are part of basic education and contribute to the harmonic development of students by stimulating their abilities and aptitudes as part of their formation. This was a descriptive, comparative, cross-sectional study of 66,396 students from 1st to 6th grade of primary school from the state of Nuevo Leon, Mexico who have a physical education teacher. The sample consisted of 193 schools, 43 School Zones, and 9 School Supervision Areas to which an integral assessment model of physical education was applied. The results show that boys have better physical fitness and master the execution of fundamental team sport techniques while girls do better in individual sports. In general, results were similar to other research in which boys have greater scores with regard to girls. We feel that the integral assessment model of the physical education class used in this study is a simple, useful, applicable instrument that considers most of the elements of a physical education program. It will be very useful for physical education teachers who work in basic education who will have an instrument with reference values to compare with the data of their students, since reference values are currently lacking and teachers who use them usually resort to tables from other countries.

Keywords: Assessment, physical education, primary school, children, sports.

1. INTRODUCTION

One of the main purposes of education is to prepare autonomous individuals who are capable of adapting and adjusting to the greatest number of situations. Physical education classes are part of this basic education and contribute to the harmonic development of students by stimulating their abilities and aptitudes as part of their formation (SEP, 2016). It is understood as a form of pedagogical intervention that contributes to the integral formation of girls, boys and adolescents by developing their motor abilities and integrating their corporality. To achieve this, diverse motor actions must be performed from didactic strategies such as motor play, body expression, sports initiation, and sports education, among others. Educational assessment is a formative process, a permanent action within teaching, and an opportunity for continuous improvement. It is important to observe and listen to what students do and say, how they resolve their motor tasks, how they interact and assume attitudes, and what evaluation they perform regarding the achieved results (SEP, 2017).

On the other hand, assessment of physical education is a topic that concerns most teachers because there is very little literature and there is no established criteria to follow. Castejón (1996) points out that the value and efficacy of school physical education programs are more

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frequently evaluated in terms of “I believe...” and “I think...” than by indicators that project educational and social quality.

In the school setting, assessment has been traditionally associated with penalization or punishment. This idea has changed and acquired a different meaning as Blázquez (2017) points out, understanding that it as a critical reflection of the components and exchanges in any process with the aim of determining what are or have been the results to be able to make the most appropriate decisions for positive achievement of the objectives pursued.

Many times we ask ourselves what the purpose of evaluating students in physical education is and we try to justify the importance of the student's progress. In this sense, Díaz (2005) proposes as a purpose: diagnosing, knowing the performance and progress of students, evaluating the effectiveness of teaching, grouping and classifying, obtaining data for research, motivating and encouraging, addressing diversity, and regulating the teaching and learning process.

Several authors (Blázquez, 2017; Bejines, & García, 1999) have divided the assessment into three phases of the teaching-learning process: before, during, and after (continuous assessment). In the initial assessment, valid references of the student's knowledge can be obtained, determining the presence and absence of different capacities and/or motor abilities. The ideal moment for this is at the beginning of the school year. Formative assessment is performed during the entire process to verify the achievement and validity of the proposed objectives and the content of each teaching unit. Summative assessment is performed at the end of the process and consists of a synthesis of the level achieved by the student and the efficacy of all the elements of the educational process.

The physical education class allows evaluating different factors (Bissonette, 2000; Blázquez, 2017; Díaz, 2005). First of all, three very concrete areas, cognitive, motor and affective-social, since all of these intervene in the personal development and maximum acquisition processes of potential development that physical education programs establish. Regarding the teacher, it is necessary to take into consideration as main links, the topics of student expectations, the teacher's adaptation to these, the correct use of materials and available spaces, involvement in the evolving development of students, and the care of students with special needs (Bailey, Armour, Kirk, Jess, Pickup, Sandford, & BERA PESPSIG, 2009).

There are different protocols that have been used to assess physical education. An example of these is the Eurofit tests, which have been widely used to assess physical fitness in the school setting, especially in Europe (Gálvez, 2010; Grosser, & Starischka, 1989; Lovecchio, Casolo, Invernizzi, & Eid, 2012; Ureña, 1998; Verstraete, Cardon, De Clercq, & Bourdeaudhuij, 2007), and the Mexican School Pentathlon in Mexico (Ceballos, Álvarez, Torres, & Zaragoza, 2009). In general, these are associated with quantitative assessment and objectivity, and with the trials, scales and tests that comprise very specific tasks which can be measured and scaled based on a conventional unit of measure. In contrast, qualitative assessment is associated with subjectivity and with observation and recording instruments.

The aim of this study was to determine motor, cognitive, affective and social skills using an integral assessment model of the physical education class of 1st to 6th grade students of primary education to obtain reference data by school level and gender.

2. METHODS AND MATERIALS

2.1 Population of the Study

This was a descriptive, comparative, cross-sectional study of 66,396 students from 1st to 6th grade of primary education from the state of Nuevo Leon, Mexico who have a physical education

teacher. The sample consisted of 193 schools, 193 schools, 43 School Zones, and 9 School Supervision Areas to which an integral assessment model of physical education was applied (Table 1).

Table 1: Distribution of students by gender and grade

Grade	1 st	2 nd	3 rd	4 th	5 th	6 th
Boys	6944	6311	5881	5624	4933	3982
Girls	6448	6137	5757	5603	4790	3986
Total	13392	12448	11638	11227	9723	7968

2.2 Instruments used and Procedure of the Study

The instrument used was the “Integral Assessment of Physical Education” designed ad hoc for this study. It is based on practical experience, the Physical Education Program (SEP, 2006, 2016), a thesis (Ceballos, 1997; 2002), books (Ceballos *et al.*, 2009) and a review by experts (physical education professors with more than fifteen years of experience) in each of the tests and questionnaires that comprise it. Its application was divided into three school years in primary level school children:

- In first grade, motor tests were applied to assess balance, orientation and reaction, in addition to a questionnaire of nutrition and hygiene concepts and of individual attitudes.
- In second grade, motor tests were applied to assess rhythm, synchronization, differentiation, and adaptation; also a questionnaire of coordinated physical abilities and of social attitudes were applied.
- in third grade, physical fitness tests were applied to assess flexibility, arm strength (flexions), abdominal strength and leg strength (long jump without running); also, a questionnaire of general concepts of the physical education program and a questionnaire of individual attitudes were applied.
- In fourth grade, physical fitness tests were applied to assess reaction to velocity, cyclic velocity, and resistance; also, a questionnaire of conditional physical abilities and of social attitudes were applied.
- In fifth grade, tests that evaluate fundamental sport techniques of soccer (conduction, pass, reception, and shooting) and athletics (throwing, long jump, velocity, and resistance) were applied; also, a questionnaire of knowledge of the setting and effects of physical exercise on the body and a questionnaire of individual attitudes were applied
- In sixth grade, test to assess fundamental sports techniques of basketball and volleyball were applied; in addition a questionnaire of fundamental techniques of soccer, athletics, basketball and volleyball, and other social attitudes was applied.

It is important to point out that the elements proposed for evaluation are based on the content of the physical education program and its recommended application in the formative evaluation stage; in other words, during the teaching-learning and the ability development processes. Fundamental techniques are evaluated through observation of the following scale: 1= Does not do it; 2= Does it poorly; 3= Needs improvement; 4= Does it correctly; 5= Excellent.

The application procedure consisted of the following activities:

- Physical education teacher training on the development, measurement and assessment of tests using theoretical-practical counseling in the different physical education supervisions as well as a workshop where the teachers captured the students' data in a computer (the majority

delivered the data; however, there were some errors in the capture therefore it was necessary to review each item and eliminate those that did not coincide).

- Control and follow up of the assessment was performed by the physical education teacher using the structure of the Physical Education and School Sports Administration.
- An open communication channel was maintained (especially by telephone) to solve possible doubts and receive suggestions.
- Assessment dates and the delivery-reception of information were calendared.
- Most of the physical education teachers knew and adapted the dosification of the physical education assessment into their daily work.
- The assessment of the content and annual dosification of the physical education program was integrated into daily work.

2.3 Data Analysis

Data were analyzed using the statistical program SPSS version 22. For comparison of tests and questionnaires for each grade and gender, contingency tables were used for categorical variables and independent means for numerical variables (Student's *t*-test).

3. RESULTS

The results are expressed in tables according to school year; tests are specified and values are compared according to gender. Coordinative physical abilities in first-grade students showed significant differences in the ability to react (visual) to catch a handkerchief with this being better in boys (2.05 ± 0.85) than girls (1.98 ± 0.88); for second grade, the ability to differentiate (number of times they throw a ball in a circle) was different between boys and girls ($p < 0.01$). No differences were observed in the rest of the variables and in the food and hygiene and individual and social attitude questionnaires (Table 2).

Table 2: Coordinative physical abilities and the food and hygiene questionnaire (questionnaire 1) and individual and social attitude questionnaire (questionnaire 2) of 1st and 2nd grade schoolchildren according to gender

Grade	Tests	Gender	X	SD	p value
1 st	Balance (seconds)	Boy	6.33	4.14	0.883
		Girl	6.32	4.09	
	Orientation, 10 trys	Boy	7.21	2.39	0.717
		Girl	7.23	2.36	
	Reaction, 3 trys	Boy	2.05	0.85	0.003
		Girl	1.98	0.88	
	Questionnaire 1, 10 questions	Boy	6.88	2.38	0.738
		Girl	6.86	2.37	
	Questionnaire 2, 10 questions	Boy	7.66	1.88	0.426
		Girl	7.61	1.89	
2 nd	Rhythm, 10 trys	Boy	7.36	2.18	0.692
		Girl	7.34	2.18	
	Synchronization, 8 trys	Boy	5.57	2.27	0.563
		Girl	5.60	2.32	
	Differentiation, 5 trys	Boy	2.91	1.43	0.000
		Girl	2.75	1.45	
	Adaptation, 3 trys	Boy	2.43	1.16	0.105

	Girl	2.38	1.10	
	Boy	7.75	1.68	
Questionnaire 1, 10 questions	Girl	7.72	1.65	0.601
	Boy	8.06	1.63	
Questionnaire 2, 10 questions	Girl	8.00	1.65	0.271

When physical fitness variables were analyzed, third-grade boys had better values in reaction velocity, velocity in 30 m, and resistance running. Regarding fourth graders, results also showed that boys did more abdominal exercises in one minute and a greater long jump in comparison to girls. No differences were observed in the rest of the variables and in the general knowledge of physical education and the individual attitudes questionnaires (Table 3).

Table 3: Conditional physical abilities from the conditional physical abilities questionnaire (questionnaire 1) and the individual and social attitudes questionnaire (questionnaire 2) in third and fourth grade schoolchildren according to gender

Grade	Tests	Gender	X	SD	p value
3rd	Velocity reaction	Boy	3.49	0.99	.000
	Time (seconds)	Girl	3.62	0.93	
	Cyclic velocity	Boy	6.40	1.38	.000
	Time (seconds)	Girl	6.58	1.41	
	Resistance	Boy	4.14	1.69	.002
	Time (min)	Girl	4.29	1.83	
	Questionnaire 1	Boy	7.53	1.78	.373
	10 questions	Girl	7.47	1.78	
	Questionnaire 2	Boy	8.25	1.48	.069
	10 questions	Girl	8.34	1.37	
4th		Boy	0.55	5.41	.758
	Flexibility (cm)	Girl	0.58	5.32	
	Arm flexions,	Boy	6.97	4.11	.061
	Repetitions/min	Girl	6.79	4.2	
	Abdominal exercises,	Boy	10.26	5.18	.000
	Repetitions/min	Girl	9.66	5.06	
		Boy	1.08	0.24	.000
	Long jump (m)	Girl	1.02	0.256	
	Questionnaire 1 - 10	Boy	7.34	1.99	.609
	questions	Girl	7.38	2.02	
	Questionnaire 2 -10	Boy	7.90	1.82	.158
	questions	Girl	7.99	1.78	

In general, the execution of fundamental techniques of soccer, basketball and volleyball are done correctly and excellently by boys in comparison to girls, which indicates that boys are more developed in these sports. this could be because they dedicate more time to these sports in their free time; however, girls do better in executing the fundamental techniques of activities of athleticism distinguishing themselves in this sport because of its individuality (Table 4).

Table 4: Fundamental techniques of soccer in fifth grade school children and athletics in sixth grade school children according to gender

Grade	Sport	Fundamental	Gender	1	2	3	4	5	Total	p value
5°	Soccer	Conduction	Boys	93	576	1489	1588	874	4620	.035
			Girls	95	534	1483	1515	834	4461	
		Pass	Boys	101	664	1530	1537	774	4606	.000
			Girls	120	617	1607	1404	695	4443	

6°	Athletics	Reception	Boys	225	873	1551	1279	649	4577	.036
			Girls	224	938	1434	1214	600	4410	
		Shooting	Boys	141	678	1503	1466	758	4546	.259
			Girls	160	591	1544	1375	743	4413	
		Throw	Boys	35	289	858	836	364	2382	.000
			Girls	48	239	805	785	439	2316	
		Jump	Boys	43	347	917	698	385	2390	.008
			Girls	48	327	797	696	448	2316	
		Velocity	Boys	41	235	842	824	425	2368	.017
			Girls	45	250	814	711	471	2291	
		Resistance	Boys	37	287	892	702	426	2344	.692
			Girls	39	288	826	675	437	2265	
	Basketball	Dribbling	Boys	64	243	1090	1121	682	3200	.000
			Girls	105	427	1173	990	477	3172	
		Pass	Boys	65	266	1093	1082	649	3155	.000
			Girls	115	423	1190	902	473	3103	
	Volleyball	Reception	Boys	53	247	1066	1174	656	3196	.002
			Girls	68	363	1166	1022	536	3155	
		Shooting	Boys	102	266	1015	1025	633	3071	.000
			Girls	93	375	1152	851	544	3015	
		Serve	Boys	74	287	830	772	430	2393	.000
			Girls	82	327	915	773	339	2436	
		Low hit	Boys	70	381	794	712	437	2394	.022
			Girls	87	446	820	721	364	2438	
		Volley	Boys	54	318	871	726	393	2362	.016
			Girls	62	390	918	699	340	2409	
		Spike	Boys	232	650	758	436	233	2309	.053
			Girls	274	708	765	406	207	2360	

Note: 1= Does not do it; 2= Does it poorly; 3= Needs improvement; 4= Does it correctly; 5= Excellent.

Next, we show that in the questionnaires that assess environmental conservation and effects of physical exercise on the body and the individual attitudes of fifth-grade primary school students does not show any significant difference ($p < 0.05$) between boys and girls (Table 5).

Table 5: Comparison of the questions that form the environmental conservation and physical exercise in the body questionnaire according to gender in fifth-grade primary school children

Ques	Question	Gender		p value
		Boy	Girl	
1	Keeps the school patio clean	33.3%	66.7%	$p = .151$
	Identifies organic and inorganic waste	45.7%	54.3%	
	Takes care of the flora in their setting	50%	50%	
	Knows the effects of air and land pollution and their effects on the body.	59.5%	40.5%	
	Participates in forums and talks to improve the environment.	53.2%	46.8%	
	Takes strolls or walks outdoors (country, parks).	49.1%	50.9%	
	Identifies the changes of physical exercise on the body (increase in heart rate, body temperature...)	50.1%	49.9%	
	Performs physical activities at a suitable time	47.5%	52.5%	
	Knows the importance of drinking fluids to avoid dehydration.	49.5%	50.5%	
	Knows the importance of using adequate clothing for practicing sports.	55.2%	44.8%	
2	Listens	38%	62%	$p = .901$
	Knows how to discuss	71.4%	28.6%	
	Accepts other points of view	40%	60%	
	Is interested in learning	40%	60%	
	Accepts the behavior of other classmates	51.8%	48.2%	

Cooperates with others in games	47.4%	52.6%
Takes care of the installations and material	48%	52%
Values his classmates' achievements	49.5%	50.5%
Shows confidence when moving	50.5%	49.5%
Helps classmates when they make mistakes	49.6%	50.4%

Note: Ques 1. Environmental conservation and effects of physical exercise on the body questionnaire. Ques 2. Individual attitudes questionnaire.

The questionnaires that evaluate knowledge of the fundamental techniques show greater knowledge by the boys in comparison to the girls in sixth grade primary school children ($p < .05$). With regard to social attitudes, very different behaviors were found for both genders ($p < .01$).

Table 6: Comparison of the questions that make up the knowledge of the fundamental techniques of football, athletics, basketball and volleyball questionnaire as well as the social attitudes questionnaire in 6th grade primary school children according to gender

Ques	Question	Gender		p value
		Boy	Girl	
1	Knows how to receive, pass and shoot the ball at the goal in soccer	72%	28%	$p=.033$
	Knows the position of the players on the soccer field	75%	25%	
	Knows the difference between a direct and indirect free kick.	59%	41%	
	Knows how to make a throw-in in soccer	59.20%	40.80%	
	Identifies a velocity and resistance race	48.30%	51.70%	
	Distinguishes the different types of throws	50.80%	49.20%	
	Knows the different types of jumps in athletics	47.80%	52.20%	
	Knows the crouch and standing start of sprinting	52.80%	47.20%	
	Distinguishes a dribble, pass and hoop shot in basketball	57.50%	42.50%	
	Knows what a pivot is in basketball	53.10%	46.90%	
	Knows that value of a basket in basketball	79.40%	20.60%	
	Knows the basic rules of basketball	55.60%	44.40%	
	Knows the low and high serve in volleyball	53.80%	46.30%	
	Differentiates blocking and spiking	47.80%	52.20%	
2	Knows the position of the players in volleyball	60%	40%	$p=.001$
	Knows the basic posture for low hits and volleys	60.90%	39.10%	
	Know how to work in a team	70%	30%	
	Accepts rules and respects them	16.7%	83.3%	
	Helps his/her classmates	36.7%	63.3%	
	Takes care of class material	55.4%	44.6%	
	Uses sports installations correctly	58.2%	41.8%	
	Cooperates with classmates during games	43.8%	56.3%	
	Respects the teacher's decisions	54.3%	45.7%	
	Accepts triumphs with humility	47.7%	52.3%	
	Accepts losses with optimism	49%	51%	
	Is responsible for his/her social environment	51.9%	48.1%	

Note: Ques 1. Knowledge of the fundamental techniques of soccer, athletics, basketball and volleyball questionnaire. Ques 2. Social attitudes questionnaire.

4. DISCUSSION

The evaluation of physical education must consider all the conditions and the context in which the teaching and learning process takes place. This will lead to an evaluation of the student, the teacher and the process itself. An evaluation of the process itself will be an evaluation of the context and the conditions in which it is produced or developed as well as the content of the physical education class (Sales, 1997). The assessment of the physical education class is a relatively recent subject of study and analysis in Mexico and countries of Latin America. Since

literature is scarce, there is no established criterion to be followed and sometimes physical education is evaluated more in terms of “I believe...” and “I think...” instead of by indicators that highlight the key learnings and their educational and social quality (Castejón, 1996; SEP, 2017).

For this study, coordinative physical abilities in first-grade school children showed significant differences between boys and girls in reaction (visual) in catching a handkerchief and in second grade, in differentiation (number of times they throw a ball in a circle); in the rest of the variables there were no differences by gender. In a study performed in the same state (Ceballos, 2009), a significant association was found between conditional and coordinative physical abilities. Flores (2003) conducted a study on the coordinative abilities of preschool students in Mexico. The results show that boys get better scores than girls. Adaptation improves in preschool children who have a physical education teacher and their orientation capacity is better in boys than in girls. In balance, second-graders get better values than third-graders in contrast, in orientation capacity, third-graders had better results than second-graders.

On the other hand, Torralba, Vieira, Lleixà and Gorla (2016) mention that the students in primary education in Barcelona and its province have a coordinative level lower than expected for their age although boys have significantly better results than girls.

Coordinative abilities allow coupling, where the subject is able to combine and execute two or more motor actions successively; for example, running and jumping continuously. These abilities are known as combined motor abilities or kinetic chains because they emerge from the possibility of combining abilities like links (Renzi, 2009).

When analyzing physical fitness variables, third-grade boys had better scores in reaction velocity, velocity in 30 m, and resistance running. Regarding fourth graders, boys did more abdominal exercises in one minute and a greater long jumps in comparison to girls. Flexibility does not reflect significant differences; however, these results are striking since there are several studies (Blázquez, 2017, Ceballos 2002, Delgado *et al.*, 1997, Ureña, 1998) that indicate that girls are more flexible at these ages, something that did not occur in this work. The causes can be many (biological characteristics, hereditary, environmental factors, the experience of the physical education teacher, extracurricular activities) with their analysis being outside of the scope of this research. On the other hand, it is important to point out that the scores obtained in flexibility were in general very low.

Assessment of the fundamental techniques shows a greater dedication of boys towards the practice of team sports or also activities that they carry out spontaneously, a situation that contributes to better control of their body scheme, and therefore, better efficiency in the practice of these sports. In this sense, authors such as Delgado, Gutierrez and Castillo (1997) describe in a detailed way the physical-sports training that can be done from childhood to adulthood and the enjoyment of motor skills in physical education class (Donnelly *et al.*, 2017; Hoeboer, de Vries, Mast, & Savelsbergh, 2017).

The use of questionnaires to assess individual and social attitudes shows that students from 1st to 5th grade have a similar behavior both in girls and boys; however, this changes for 6th graders, where the social attitudes of men score better in their ability to work in a team, care for the class materials, the use of sports facilities, and respect for the teacher's decisions. In contrast, girls accept rules better, and help and collaborate with their classmates. A study by Aydoğan (2016) shows that girls in primary education in Turkey have better positive attitudes in the physical education class than boys. Regarding the content of physical education class, 6th grade boys show greater knowledge.

The globalization approach in the elementary physical education area shows different positions on the part of the teacher, since they currently carry out objective evaluations through standardized tests. On the other hand, there is an opposite position where qualitative assessments should predominate; where the activities designed for assessment must be similar or equal to the

usual ones and which uses observation and recording as the fundamental instruments (Pieron, 1992). Continuing with this line, Blázquez (2017) comments that observation should include the personal impressions of the student by the teacher. It is convenient for the teacher to observe and evaluate the different teaching/learning activities and should record on a sheet designed for this purpose, the individual and collective evolution of the students. This observation will allow the detection of difficulties when they occur and will allow the teacher to take the necessary measures in a timely manner (Blázquez, 2017). The physical education assessment model proposed in this study considers both types of assessment and shows the flexibility to adapt to the educational context.

5. CONCLUSION

We feel that the integral assessment model of the physical education class used in this study is a simple, useful, applicable instrument that considers most of the elements of the physical education programs currently used in Mexico and other Latin American countries. It will be of great value for physical education teachers who work in basic education since they will have an instrument that considers traditional and competency assessments using reference values according to school grade and gender.

It was confirmed that in Nuevo Leon, Mexico, boys dominate the fundamental techniques of team sports and girls, individual sports. In general, our results were similar to other research where boys have higher scores than girls. This research is the result of an integral assessment physical education project that trained close to 500 specialized teachers in the state of Nuevo Leon and which benefited more than 60,000 primary school children.

6. ACKNOWLEDGMENTS

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