Weekly Quizzes as a Predictive Factor of Final Academic Performance in Morphology

Controles Semanales como Factor Predictor del Rendimiento Académico Final en Morfología

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SUMMARY: Academic performance has been defined as the achievement of goals, results or objectives established in the subject program that the student is taking and it is important to study the factors that can predict it. The objective of this study is to establish the correlation between performance in weekly quizzes with performance in global tests and the final exam of first year Odontology students at the Universidad de los Andes. We measured 737 observations corresponding to the average of weekly morphology quizzes with the average of the semestral morphology global tests and the final exam, taken by 370 students admitted in first year of Odontology at the Universidad de los Andes between the years 2011 to 2014 included. The data was analyzed with Student's T test and Pearson's correlation. Continuous variables were described with measures of central tendency and dispersion. There is a significant positive correlation (p value <0.001), between the average of the morphology weekly control grades and the averages of global test grades of 0.736; between the average of the weekly control grades and the final exam grade of 0.577 and between the average of global test grades and the exam grades of 0.763. According to our observations, the results of the weekly control grades correlate positively with the results of the global tests and the final exam, so it could be considered as one of the measurable predictors of academic performance.

KEY WORDS: Basic sciences assessment; Educational measurement; Education; Dental; Educational measurement; Educational assessment.

INTRODUCTION

Academic performance has been defined as the achievement of goals, results or objectives established in the program that the student is taking. From an operational point of view, this indicator has been limited to the expression of a quantitative grade (Vélez van Meerbeke & Roa González, 2005). Despite the risk of using only grades to measure academic performance in higher education, these are still the most used means to quantify academic performance, mainly due to the possible subjectivity of teachers (Ocaña Fernández, 2011).

It is important to study the factors that can predict such academic performance in order to improve it. According to this, some models that organize different factors influencing performance have been proposed, as for example the one Cueto Grade *et al.* (2004), where they grouped into: factors associated to the educational center (García Aretio, 1989); factors associated with the family

(Kreig & Uyar (1997); and factors associated with the student (Lundberg, 2003).

Factors that positively or negatively influence academic performance, such as previous school results, state tests, college entrance exams, intellectual skills, psychosocial factors, personality traits and emotional factors, study habits and vocational interest, among others have been studied (Ferguson *et al.*, 2002; Kim & Lee, 2007; Alhadlaq *et al.*, 2015).

Among the factors that positively influence academic performance are cognitive-motivational variables, where the motivational variables are the causal characteristics. According to the attributional theory (Weiner, 1985, 1990), what really determines motivation is the different interpretations and evaluations that a person makes of its own academic results. On the other hand, different authors

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(Weiner, 1985), consider that the variable that plays a central role in motivation and school learning is the self-evaluation, that is, a set of perceptions and beliefs that a person has about itself in different areas (Valle Arias *et al.*, 1998). Another very strong predictor of university academic performance is cumulative or weighted average performance in the same university, where it was determined that the average grade of the student in the previous biannual period was the best indicator of university academic performance (Tejedor Tejedor & García-Valcárcel Muñoz-Repiso, 2013).

The effort variable is another important predictor which can be quantified taking into account criteria such as: class attendance, study strategies, approved assignments presented on time and participation during the class. All of these criteria are directly related to performance; it will be definitely better if there is more attendance to classes, more active participation during sessions, more weekly hours devoted to studying and timely delivery of academic work (Vélez van Meerbeke & Roa González).

According to the results obtained in a previous study carried out by our team, it was observed that there is a correlation between the morphology grades, PSU (from the Spanish for "university selection test") score and high school grades; when higher PSU score and higher high school grades are obtained, better academic performance is observed in morphology (Grob *et al.*, 2015). Regarding these findings, it has also been seen in other publications that a good performance in the last years of high school is highly predictive of early performance in medical related careers such as medicine, odontology and nursing (Curtis *et al.*, 2007; Alhadlaq *et al.*).

On the other hand, variables that negatively influence performance leading to academic failure have been described. An investigation carried out in Spain (Tejedor Tejedor & García-Valcárcel Muñoz-Repiso) determined that the lack of basic knowledge is one of the main causes of academic failure, so a previous low performance can be highly predictive (Grob *et al.*). In this regard, some authors determined that, in teacher's opinion, the variable that most affects low performance is the low level of previous knowledge of the student taking the course, followed by a lack of self-control, self-determination and responsibility (Ocaña Fernández; Tejedor Tejedor & García-Valcárcel Muñoz-Repiso). The hours dedicated to extracurricular work could reduce the time dedicated to studying. Krieg & Uyar (1997) and Lundberg indicate that extracurricular work hours had a negative impact on the students' performance.

Finally, as far as academic load is concerned, it affects academic performance. Thus, Girón Cruz & González

Gómez (2005), based on information from an economics program, found that if the student decreased the number of credits in which he was enrolled, his general (average) performance increased.

The aim of this study was to establish the association between academic performance in weekly quizzes during the first and second semesters with morphology global (partial) tests performance and the final exam, in first year students of Odontology at the Universidad de los Andes, Santiago, Chile. This, in order to gather more information that would help to predict the usefulness of weekly quizzes in determining success or failure in the morphology final evaluations; which would help to propose new evaluation strategies and strengthen continuous study.

MATERIAL AND METHOD

This study has been approved by an ethics committee that reviews and approves studies involving human subjects.

A prospective, longitudinal, observational cohort study was performed, in which the information from 737 evaluations was observed, corresponding to the morphology (subject that integrates anatomy and histology) weekly quizzes average, the morphology global tests average and the final exam, from both semesters. This information corresponded to the evaluations of 370 students admitted in first year of Odontology at the Universidad de los Andes, who took morphology for the first time, excluding repeaters and those coming from other careers. Data from the years 2011 to 2014, included, was analyzed, period in which the same teachers worked and the same learning outcomes were evaluated. The information was obtained through an anonymous database provided by the Department of Studies of the Faculty of Odontology. The studied variables were sex (dichotomous variable), average of weekly morphology quizzes from the first and second semesters separately (dichotomous variable), the average of morphology global tests from the first and second semesters separately (continuous variable) and the final exam grade of each semester (continuous variable).

The average of quizzes, global tests and exam grades were expressed on a scale from 1 (minimum grade) to 7 (maximum grade), with 1 decimal differences.

The validity of quizzes and tests is given by the fact that the same learning outcomes were evaluated. The reliability of the instruments was evaluated with Cronbach Alpha.

Statistical analysis. Data was analyzed using averages and standard deviation; we compared the differences between dichotomous variables with a Student t Test using a 95 % confidence interval, 2-tailed. Continuous variables were described with measures of central tendency and dispersion. Pearson's correlation was used to determine the coefficient of association with a significance level of 0.01 (2-tailed). The information was processed using the SPSS® program.

RESULTS

The study included 370 students, who entered the career of Odontology between 2011 and 2014. A total of 737 observations were analyzed. The average grade of the morphology weekly quizzes was 4.39 (SD = 0.59), the average grade of the morphology global tests was 4.28 (SD = 0.62) and the average grade of the exam was 4.42 (SD = 0.76).

The average number of students per semester was 70. Of the total sample, 275 students (75 %) were female and 90 students (25 %) were male.

Reliability is given by a Cronbach Alpha average of 0.71 with a standard deviation of +/- 0.08. The best Cronbach Alpha result was of 0.86 and the lower was 0.50. This implies that the instruments with which the students were evaluated aimed to measure the same learning results, being highly reliable in discriminating the students that had better and worse performance within each cohort.

Of the observations, 539 were women; the average grade of the weekly quizzes was 4.44 (SD = 0.59), the average grade of the morphology global tests was 4.32 (SD = 0.60) and the average grade of the exam was 4.50 (DS = 0.65) (Table I).

Of the observations, 191 were men; the average grade of the weekly quizzes was 4.30 (SD = 0.55), the average grade of the morphology global tests was 4.23 (SD = 0.59) and the average grade of the exam was 4.36 (DS = 0.63) (Table I).

Table I. Average Tests Table by Sex.

	Quizes	SD	Global	SD	Exam	SD
Female	4.44	0.59	4.32	0.6	4.5	0.65
Male	4.3	0.55	4.23	0.59	4.36	0.63
Total	4.39	0.59	4.28	0.62	4.42	0.76

Average values of weekly semiannual quizzes, global semi-annual tests and final exam from 2011 to 2014 by sex.

Regarding the difference between sex, the analysis of the t Test gave us a statistically significant difference between men and women in both the averages of the exam (t <0.008) and weekly quizzes (t <0.004) where women obtained a better result, whereas there was no statistically significant difference between sexes in the global tests (t <0.53).

When analyzing the data by semester, 372 observations corresponded to the first semester with an average grade on weekly quizzes of 4.46 (SD = 0.57), an average grade on global tests of 4.43 (DS = 0.63) and an average grade on the exams of 4.45 (SD = 0.73).

358 observations corresponded to the second semester, where the average grade on weekly quizzes was 4.34 (SD = 0.59), the average grade on the global tests was 4.16 (SD = 0.53) and the average grade on the exams was

Table II. Average Tests Table by Semester.

	Quizzes	SD	Global	SD	Exam	SD
First	4.46	0.57	4.43	0.63	4.45	0.73
Second	4.34	0.59	4.16	0.53	4.39	0.54
Total	4.39	0.59	4.28	0.62	4.42	0.76

Average values of weekly quizzes, global semi-annual tests and final exam from 2011 to 2014 by semester.

Comparing the two semesters, a significant difference was observed in the average grades of quizzes (t <0.007), global tests (t <0.0001) and exams (t <0.002), where better results were obtained during the first semester (Table II).

When comparing the averages between years (cohorts) we saw that there were no significant differences (t <0.037). The data is detailed in Figure 1.

The correlation results based on the different evaluated parameters in this study were as follows:

There is a positive significant correlation (p value <0.001) between the morphology quizzes averages and the global test averages of r= 0.736 (Fig. 2); between the quizzes averages and the final exam of r= 0.577 and between the global test averages and the exam of r= 0.763.

Female had a positive correlation between quizzes averages and global test averages of r= 0.738 with a p value <0.0001, between the quizzes averages and the exam of r= 0.603 with a p value <0.0001 and between the global test averages and the exam of r= 0.789 with a p value <0.0001.
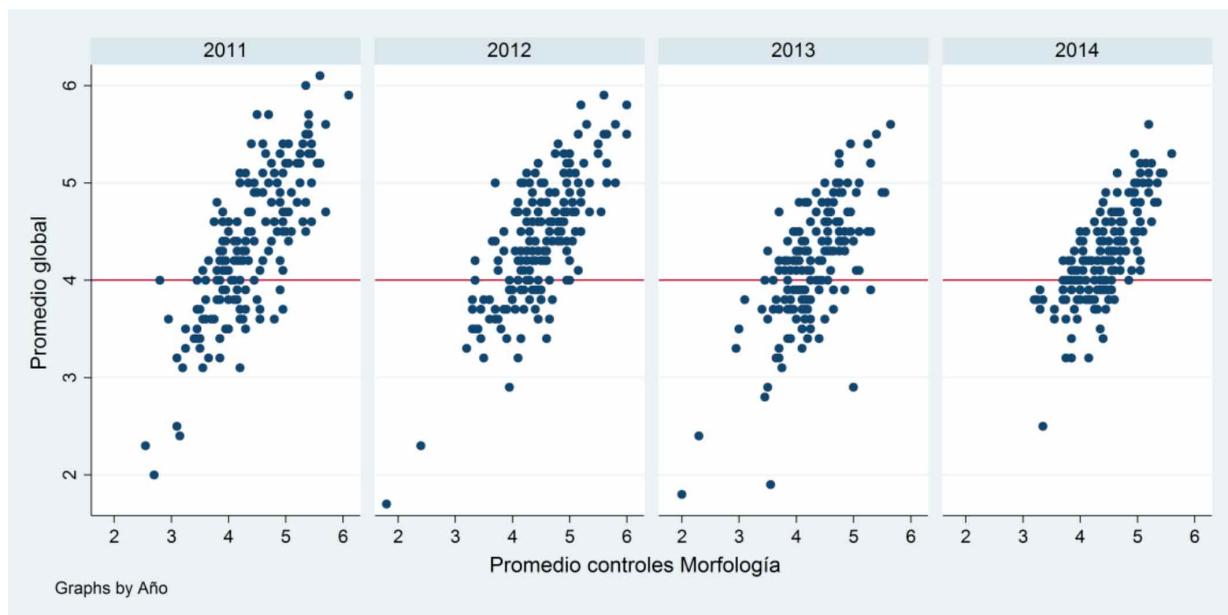
Fig. 1. Correlation of morphology controls v/s morphology global tests in different cohorts.

Male had a positive correlation between the quizzes averages and the global test averages of 0.725 (Fig. 3) with a p value <0.0001, between the quizzes averages and exams of 0.597 with p value <0.0001 and between the global test averages with the exam of 0.779 with a p value <0.0001.

In the first semester there was a positive correlation between the quizzes averages and global test averages of r= 0.737 with a p value <0.0001, between the quizzes averages and exam of r= 0.666 with a p value <0.0001 and between the global test averages and the exam of r= 0.844 with a p value <0.0001.

During the second semester there was a positive correlation between the quizzes averages and global test averages of r= 0.720 with a p value <0.0001, between the quizzes averages and the exam of r= 0.509 with p value <0.0001 and between the global test averages and the exam of r= 0.675 with a p value <0.0001

DISCUSSION

This was a longitudinal, prospective cohort study that included 370 students of whom 75 % were women and 25 % were men. It has been reported in literature that more longitudinal and case-control studies are needed to better examine predictors of academic success (Ferguson *et al*.). For this purpose, weekly quizzes average during semesters were used as predictors of performance.

A correlation between weekly quizzes and global tests (R = 0.736) and the final exam (r = 0.577) was established in this study, being therefore, the weekly quizzes performance highly predictive of both the global test and final exam performances. Morphology is the subject that represents the highest amount of credits during the first year of Odontology at the Universidad de los Andes. This difference could be explained by the methodology used in these quizzes, which are carried out week by week, which implies prior knowledge and preparing the subject in advance, as described by multiple authors, where basal knowledge is a good predictor, although not perfect (Ferguson *et al*.).

In addition, we can see that there is also a high correlation between good performance in the global tests and the final exam (R = 0.763), which implies that improving the accumulated performance requires effort and perseverance, a need to attend to the class, improve study strategies, increase the amount of weekly hours devoted to it, allowing to immediately raise doubts to the teacher and updating the studied contents (González *et al*., 2008). The effort variable has been widely studied, being estimated that all those criteria that are directly related, improve academic performance (Krieg & Uyar; González *et al*.).

The weekly quizzes average grade was 4.39 (SD = 0.59), the morphology global tests average grade was 4.28 (SD = 0.62) and the exam average grade was 4.42 (SD = 0.76), where these three values are similar with minimal differences in the results obtained between them and all the

averages are above the minimum acceptable mark to pass the subject, that is a 4.0.

Regarding sex, we found that women had an average of 4.4 in the quizzes and 4.5 on the exam, while men had a 4.3 average on quizzes and 4.36 on the exam. We obtained a statistically significant difference between men and women in both the exam (t <0.008) and quizzes averages (t <0.004), where women performed better. Many researches have focused on the differences of men and women in different intellectual areas. Our results are consistent with the results of Kim *et al*. where they found a significant correlation between academic performance and sex during the first semester of Odontology, where women scored better. A meta-analysis by Voyer & Voyer (2014) concluded that there is a stable advantage in the performance of women. In a review by Ferguson *et al*., it was observed that different authors agreed that women do better than men in academic performance and are more likely to obtain degrees of honor. On the other hand, different variables that influence academic performance have been related to sex such as motivation, demographic factors and academic factors (Ferguson *et al*.). Despite our statistically significant results, from an academic point of view, the difference of a decimal in the grade does not make a big difference.

In the present study we observed that a significantly better performance is obtained during the first semester with a significant difference in the average of quizzes (t <0.007), global tests (t <0.0001) and exam grades (t <0.002). In addition, we found a positive correlation between the quizzes averages and global test averages of 0.737 with a p value <0.0001, between the quizzes averages and the exam of 0.666 with a p value <0.0001 and between the global test averages and the exam of 0.844 with a p value <0.0001, which implies that weekly quizzes during the first semester are strongly predictive of final performance. These results are consistent with those published by Vélez van Meerbeke & Roa González, who observed that the first semester grades had a great association with final performance, where having a low average in the first trimester, proved to be one of the variables that was most associated with academic failure.

In conclusion, the results of the weekly quizzes correlate positively with the results of the morphology global tests and final exam, so they could be considered as one of the good and measurable predictors of academic performance.

BECERRA, D. A.; GROB, M. S.; SOTO, R.; TRICIO, J. & SABAG, N. Controles semanales como factor predictor del rendimiento académico final en morfología. *Int. J. Morphol., 37(1)*:296-301, 2019.

RESUMEN: El rendimiento académico ha sido definido como el cumplimiento de las metas, logros u objetivos establecidos en el programa o asignatura que está cursando un alumno y resulta importante estudiar aquellos factores que lo puedan predecir. El objetivo de este estudio fue establecer la correlación entre el rendimiento en controles semanales con el rendimiento de las pruebas globales y del examen final en alumnos de primer año de Odontología de la Universidad de los Andes. Se midieron 737 observaciones correspondiente a los valores de los promedios de controles semanales de morfología con el promedio de las pruebas globales semestrales de morfología y el examen final del semestre, rendidas por 370 estudiantes admitidos en el primer año de la carrera de odontología en la Universidad de los Andes entre los años 2011 al 2014 incluidos. Se analizaron los datos con test T student y Correlación de Pearson. Las variables continuas se describieron con medidas de tendencia central y dispersión. Existe una correlación positiva con un nivel de significancia de (p value < 0,001) de los promedios de los controles de morfología con los promedios de las pruebas globales de 0,736; el promedio de los controles con el examen final de 0,577 y el promedio de pruebas globales con el examen de 0,763. De acuerdo con nuestras observaciones el resultado de los controles semanales se correlaciona positivamente con el resultado de las pruebas globales y el examen final, lo cual podría considerarse como uno de los factores predictores medibles del rendimiento académico.

PALABRAS CLAVE: Basic sciences assessment; Educational measurement; Educación; Dental; Educational measurement; Educational assessment.

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