Artículo original

Learning styles of ethnic minority students: a matched case-control study in a dental school in Latin America

Estilos de aprendizaje en estudiantes de minorías étnicas: un estudio de casos y controles en una facultad de odontología en América Latina

Estilos de aprendizagem de estudantes de minorias étnicas: um estudo caso-controle em uma escola de odontologia da América Latina

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Abstract

Introduction and objective: Little is known about the learning styles of ethnic minorities in Latin American universities. The objective of this research was to identify the learning styles of the ethnic minorities attending a dental school. Moreover, their grade point averages were explored. **Materials and methods:** A total of 30 ethnic minority students were matched with 30 non-minority students. All the students took a systematized questionnaire to categorize their learning styles. **Results:** A strong association between ethnic minority students and low reflector style was observed in the multivariate model after adjusting for age, sex, and the current semester (OR=11; 95% CI=1.2-99; p=0.03). In addition, a relevant association between minority ethnic group and low theorist style was observed in the multivariate model after controlling for the same variables (OR= 4; 95% CI=1.2-11; p=0.02). Finally, a statistically significant difference was observed in the grade point averages of non-minority and minority groups, with the minority group having the lower averages (p=0.014). **Conclusions:** Ethnic minority students presented lower means for all learning styles compared to the control group. Similarly, their grade point averages were significantly inferior. These findings represent relevant precedents for creating educational strategies to improve the learning of ethnic minority groups in higher education in Latin America.

Keywords: dental education; learning styles; minority groups; inequities.

Resumen

Introducción y objetivo: Poco se sabe sobre los estilos de aprendizaje de las minorías étnicas en las universidades latinoamericanas. El objetivo de esta investigación fue identificar los estilos de aprendizaje en las minorías étnicas de una facultad de odontología. Además, se exploró su promedio de calificaciones. **Materiales y métodos:** treinta estudiantes de minorías

étnicas se parearon con treinta estudiantes de minorías no étnicas. Todos los estudiantes completaron un cuestionario sistematizado para clasificar sus estilos de aprendizaje. **Resultados:** En el modelo multivariado después de ajustar por las variables edad, sexo y semestre actual, se observó una fuerte asociación entre los estudiantes de minorías étnicas y un nivel bajo en el estilo reflector (OR= 11; 1.2-99, IC 95%; p= 0.03). Igualmente, después de controlar las mismas variables, se encontró una asociación relevante entre el grupo étnico minoritario y un nivel bajo en el estilo teórico (OR= 4; 1.2-11; IC 95%; p = 0.02). Además, se observaron diferencias estadísticamente significativas en el promedio de calificaciones entre los grupos, el cual fue menor en el grupo minoritario (p = 0.014). **Conclusion:** los estudiantes de minorías étnicas presentaron promedios más bajos para todos los estilos de aprendizaje en comparación con el grupo control. Del mismo modo, su promedio de calificaciones fue significativamente inferior. Estos hallazgos representan precedentes relevantes para crear estrategias educativas que favorezcan el aprendizaje de los grupos étnicos minoritarios en la educación superior en América Latina.

Palabras clave: educación dental; aprendiendo estilos; grupos minoritarios; inequidades.

Resumo

Introdução e objetivo: Pouco se sabe sobre os estilos de aprendizagem das minorias étnicas nas universidades latino-americanas. O objetivo desta pesquisa foi identificar os estilos de aprendizagem em minorias étnicas de uma faculdade de odontologia. Além disso, sua média de notas foi explorada. **Materiais e métodos:** Um total de trinta estudantes de minorias étnicas corresponde a trinta estudantes de minorias não étnicas. Todos os alunos preencheram um questionário sistematizado para classificar seus estilos de aprendizagem. **Resultados:** Observou-se forte associação entre os estudantes de minorias étnicas e o baixo estilo reflexivo no modelo multivariado após o ajuste para as variáveis idade, sexo e semestre atuais (OR = 11; 1,2-99, IC95%; p = 0,03) De maneira comparável, foi observada associação relevante entre o grupo étnico minoritário e o baixo estilo teórico no modelo multivariado, após o controle das mesmas variáveis (OR = 4; 1,2-11; IC95%; p = 0,02). Além disso, foram observadas diferenças estatisticamente significantes nas pontuações médias entre os grupos, sendo menor no grupo minoritário (p = 0,014). **Conclusões:** os estudantes das minorias étnicas apresentaram médias mais baixas para todos os estilos de aprendizagem em comparação ao grupo controle. Da mesma forma, a média de notas foi significativamente menor. Esses achados representam precedentes relevantes para a criação de estratégias educacionais que favoreçam a aprendizagem de grupos étnicos minoritários no ensino superior na América Latina.

Palavras-chave: educação odontológica; estilos de aprendizagem; grupos minoritários; desigualdades.

Introduction

Learning styles have been theorized broadly, with researchers putting forth singular models and instruments without appropriate comparisons (1). Alonso et al. (2) embraced a well-accepted theory that was initially proposed by Keefe (3). According to these authors, learning styles are the reasoning, emotional, and functional attributes that serve as relatively stable guides as learners perceive, interact with, and react to their learning framework. Thus, the students create their own learning processes, adding experience in in a cyclic manner. Therefore, with regards to the Learning

Style Questionnaire (LSQ) proposed in (4), four learning styles have been identified, namely, activist, pragmatist, theorist, and reflector (see Table 1).

Table 1. Characteristics of the four learning styles (5).

Learning Style	*Characteristics*
Activist	New experiences Open mind Enthusiastic, Improvises, Spontaneous
Reflector	Observe experiences from different perspectives Analyze carefully Prudent, Receptive, Analytical
Theorist	Adapt and integrate observations into logical theories Integrate the facts into theories Rationality and objectivity Dislike subjective or ambiguous Methodical, Critical, Organized
Pragmatist	Practical application of ideas Act quickly Experimenter, Direct, Realistic

These four learning styles are based on the inventory of learning styles proposed by Kolb (5), who described his four styles as: "assimilating, accommodating, convergent and divergent." The styles used herein correspond to the adaptation made by Honey and Mumford (4). The LSQ was verified and added to the Spanish educational frame of reference (CHAEA) (2). Thus, the CHAEA has been used to help health science students identify their learning styles (6-8). In the latest edition, comprehension with was enhanced, while preserving the core of each style, by using simpler language, which resulted in superior response options.

The learning mechanism used in the dental curriculum is complicated, including as it does the interactions between learners and educators, the courses, the application of theoretic concepts to clinical practice, the university conditions, educational backgrounds, and cultures. The representative cultures are campus determinants since cultural features affect learning (9). The ancestral antecedents of Latin American populations encompass a complex mix of European, Native American, and African populations (10). In Colombia, four major ethnic groups have been identified, with Afro-Colombians (10.6%) and indigenous people (3.4%) being the most representative (11).

The University of Antioquia is an accredited public university with approximately 36,000 students; it is ranked 17th among the universities in Latin America and is considered one of the top three universities in Colombia (12). The accredited Faculty of Dentistry admits approximately 54 students per academic semester. The university's education policies recommend that four students from ethnic minority groups (two Afro-Colombians and two indigenous) be admitted each semester; unfortunately, these places are not always occupied.

Ethnic minorities are under-represented in higher education health sciences programs in several developed countries (13-16). The under-representation is attributed to, among others, lower scores on admission tests, lower grade point averages in high school, poor preparation in the sciences, and poor communication skills (14).

On the other hand, the difficulties ethnic minorities have remaining in medical school in Australia have also been documented; they include financial support, course content, and learning styles (16).

Unfortunately, little is known about the ethnic minorities attending Latin American universities (17) and much less about access for, and retention of, ethnic minorities. Taking into account the difficulties mentioned above and the knowledge that in the field of dentistry, the combination of theoretical and practical concepts and, consequently, specific educational formats are fundamental for learning, it is essential to identify the learning styles of ethnic minority students in order to establish curricular policies.

Thus, the objective of this study was to identify the learning styles of ethnic minority dental students at a Latin America university. In addition, their grade point averages were explored.

Materials and methods

A matched case-control study was designed. All the students of the Faculty of Dentistry of the University of Antioquia belonging to ethnic minority groups (Afro-Colombians and indigenous; n=30) enrolled during the academic period 2018-2 were enrolled in this study. They completed the CAMEA40 (18) questionnaire after signing the informed consent form. Subsequently, using the data related to age, sex, and the current semester obtained from these students, a random sampling of the rest of the students was conducted in order to form a control group. Thus, thirty additional students accepted an invitation to participate, signed informed consent, and responded to the questionnaire.

The CAMEA40 contains a sequence of questions pertaining to socio-academic features and forty brief enquiries with five possible answers (always, usually, many times, sometimes, and never assigned values 5, 4, 3, 2, and 1, respectively). All questions are of equal value; consequently, the score on the questionnaire is the sum of all the responses. The range of the CAMEA40 scale runs from 0 to 50 for each of four learning styles. The questions that make up each of the learning styles were described previously (18).

The questionnaire is presented unsystematically, with ten questions for each learning style (activist, reflector, theorist, and pragmatist). A scale labels the findings for each learning style as: very low (0-18), low (19-26), moderate (27-34), high (35-42), and very high (43-50). For example, if a student has a score between 27 and 34 for the reflector style, then the student has a moderate reflector learning style. The questionnaire permits the learner to prefer more than one style of learning.

The CAMEA40 was conducted in a classroom, and the Bioethics Committee of the Faculty (concept 03-03-19) permitted this research.

Statistical Analyses

A descriptive analysis was completed first, followed by a bivariate examination using the Chi-Square test and Pearson, Kendall, and Tau-B correlations. In addition, the Student's t-test was used to examine the differences between the groups after using the Kolmogorov-Smirnov normality test to confirm that data were normally distributed. Lastly, logistic regressions were run for crude and multivariate models (assumptions were checked), accompanied by ORs and 95% confidence intervals. The level of significance was 0.05. Statistical software (SPSS version 24.0; Chicago, IL) was used to analyze the information.

Results

A total of 60 students filled in the questionnaire. Half of them corresponded to the complete group of ethnic minority students (minority group) enrolled in the dental program during 2018-2; the remaining 30 students (non-minority group) were matched with this group according to age, sex, and current semester. The non-minority group was randomly selected from the students enrolled in the dental school (n= 510).

Table 2 shows the socio-academic attributes of the 60 participants. Due to the matching, the mean age, the distribution by sex, and the current semester were the same for both groups in the study. Statistically significant differences were observed in the grade point averages for the two groups, with the minority group having the lower averages (p=0.014). However, no correlations were found between grade point average and learning style in either of the two groups.

Table 2. Socio-academic characteristics of the 60 students.

Parameter	*Minority group (n=30)*	*Non-Minority group (n=30)*	*P-value*
Age (years)	23±3[a]	23±3[a]	NS[c]
Sex[b]			NS[c]
Female	20(33%)	20(33%)	
Male	10(17%)	10(17%)	
GPA[d]	3.6±0.3[a]	4.1±0.2[a]	0.014
Current semester[b]			
1-5	19(32%)	19(32%)	NS[c]
6-10	11(18%)	11(18%)	
Public high school[b]	27(45%)	19(32%)	0.015
Work (yes)	18 (60%)[b]	7(23%)[b]	0.008

a) Values are presented as a mean± standard deviation
b) Values are presented as number and percentage
c) NS= not statistically significant
d) GPA= grade point average

It was also revealed that more students in the minority group studied at public high schools (p= 0.015) and were currently working (p=0.08); thus, statistically significant differences were observed between the minority and the non-minority groups.

Furthermore, for the minority group, statistically significant correlations were found between grade point average and studying at a public high school (r= 0.23; p=0.028) as well as currently working (r=0.42; p=0.001). The mean scores for the learning styles of the two groups were also compared (Table 3). The minority group had lower means for all learning styles, and three of these differences were statistically significant. The non-minority group had a high mean score for the theorist style.

Table 3. Mean values and ratings for the learning styles.

Learning Style	*Minority group (n=30)*	*Rating*	*Non-minority group (n=30)*	*Rating*	*P value*
Activist	24.5±4.3 [a]	l	25.1±5.2 [a]	l	NS[c]
Reflector	31.1±4.8 [a]	m	33.5±5.6 [a]	m	0.04
Theorist	31.9±4.6 [a]	m	35±4.5 [a]	h	0.01
Pragmatist	27.2±4.5 [a]	m	30±5.9 [a]	m	0.04

a) Values are presented as a mean± standard deviation
b) Rating scale: very high (vh), high (h), moderate (m), low (l), and very low (vl).
c) NS= not statistically significant

In the non-minority group, a higher number of students preferred the reflector and theorist styles (see Table 4).

Table 4. Number of students in both groups falling under each rating for the learning styles.

Minority Group						***Non-minority Group***					
Learning Style	vl[a]	l[a]	m[a]	h[a]	vh[a]	Learning Style	vl[a]	l[a]	m[a]	h[a]	vh[a]
Activist	3	16	11	0	0	Activist	3	19	7	1	0
Reflector	0	7	16	7	0	Reflector	1	1	19	7	3
Theorist	0	4	18	8	0	Theorist	0	1	12	17	0
Pragmatist	1	10	17	2	0	Pragmatist	1	6	16	6	1

a) Rating scale: very high (vh), high (h), moderate (m), low (l), very low (vl).

Taking the data in Tables 3 and 4 into account, multivariate logistic regressions were applied. The association between the minority group and low reflector style was found in the simple model (OR= 8.8; p=0.04) and increased after adjusting for age, sex, and current semester (OR=11; p=0.03) (Table 5). Similarly, an association between the minority group and low theorist style was observed in the multivariate model (OR= 4; p=0.02) (Table 6).

Table 5. Multivariate regression analysis for the minority group and low reflector learning style.

Variable	***Crude OR (95% CI)***	***P Value***	***Adjusted* (95% CI)***	***P Value***
Minority group	8.8 (1.1-76)	0.01	11 (1.2-99)	0.03
Age (years)			1.01(0.8-1.2)	NS
Sex (female)			0.9 (0.2-3)	NS
Current semester			1.1 (0.8-1.3)	NS

*Adjusted for age, sex, and semester enrolled.
NS= Not a significant association

Table 6. Multivariate regression analysis for the minority group and low theorist learning style.

Variable	***Crude OR (95% CI)***	***P Value***	***Adjusted* (95% CI)***	***P Value***
Minority group	3.6 (1.2-11)	0.02	4 (1.2-11)	0.02
Age (years)			1 (0.8-1.2)	NS
sex (female)			0.4 (0.2-1.3)	NS
Current semester			1 (0.8-1.3)	NS

*Adjusted for age, sex, and semester enrolled.
NS= Not a significant association

It is important to note that a statistically significant association between the minority group and low performance in the sciences during high school was observed ($p < 0.0001$). No associations between preclinical and clinical courses and learning styles were observed.

Discussion

Learning style has been defined as a method for scoping, recollecting, and retelling evidence, simplifying comprehension and the use of talent. Relevant aspects that impact the predilection for a particular type of learning style include individualism and the program selected for the learner (19).

In diverse cultures, the contexts of minorities and their particularities influence their learning styles; unfortunately, they have been seldom studied (9). Research conducted on indigenous students at a medical school in Australia revealed that some aspects, such as educational background, race, discrimination, cultural peculiarities, and language barriers, influenced their learning styles (16).

On the other hand, minority group's learning styles when studying dentistry have been researched very little worldwide and essentially not studied at all in Latin America. Hence, there are scant results with which to contrast our results. However, bearing in mind that the learning styles and scales used by the CHAEA are similar to those of the CAMEA40, it is possible to compare these findings with other reports on non-minority students.

In this study, the minority group had lower means for all learning styles; however, they preferred the reflector and theorist styles. These styles were also preferred by literature (18), pharmacy (6), and medical (7) students. The theorist chooses to assess difficulties from many standpoints (observing systematically) and without mechanical conditioning. Reflectors are relaxed, methodical, and infuse personality into the learning process (7). Cultural backgrounds may determine inclinations in learning styles, particularly cognitive and communication styles (9, 20).

On the other hand, in this study, the activist and pragmatist styles occurred in low levels in the two groups studied; these results corroborate those found for dental students from other cultural contexts (20, 21).

It is possible that once minority students recognize their learning styles, they will be able to improve their perseverance in learning and ponder the relevance of reinforcing their less frequently used styles (3). Equivalently, if instructors comprehend the students` inclinations in learning styles, it is possible to find instruction styles that permit students to learn more capably (6). To enable these tactics, the findings of this investigation were shared with the students and professors of the Faculty.

Most definitely, cognitive and communication styles (9, 20), educational background, race, discrimination, cultural peculiarities, and language barriers influence the learning styles of minority students (16).

This study found no connections between grade point average and particular learning styles; comparable outcomes have also occurred at other dental schools (20, 21). This research also revealed a significant correlation between grade point average and having studied at a public high school for the minority group. It has been documented that graduates of public high schools have lower grade point averages (22, 23). Additionally, it was postulated that university students who work also achieve lower grade point averages (24). This connection was also detected in this research.

Finally, this research found a statistically significant association between being in the minority group and low performance in the sciences during high school, corroborating results reported in the United States (15).

There were some limitations in the present research. This case-control study did not use sequential causal correlations. In addition, the minority group explored is not representative of the minorities in the republic; nonetheless, the University is the second-largest university in Colombia and has applicants from most territories in the nation. Also, this study included all the school's minority dental students, who were then randomly matched with students who were not ethnic minorities using relevant variables that allowed biases to be reduced and increased statistical efficiency. Additionally, case-control studies are the most appropriate epidemiological designs when the cases are infrequent. The present outcomes also partially fill the gap in investigations related to leaning styles for university minority groups and their concomitant variables.

Conclusions

The minority group presented lower mean scores for all learning styles; however, they showed a preference for the reflector and theorist learning styles. Lower grade point averages and higher needs to work were also found for this group when compared with the non-minority group. Familiarizing minority students with their learning styles can attune them to their weaknesses in learning and lead them to considering reinforcing their less frequently used styles. In addition, when faculty members recognize these propensities in learning styles, it is possible to institute teaching methods that help students learn more competently. These results could help develop guides for learning and teaching and outline educational policies to support the learning, equity, and permanence of ethnic minorities in higher education in Latin America.

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Disclosure of interest

There are no competing interests related to this study.

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