LEARNING STYLES OF ENDODONTICS STUDENTS AT A PRIVATE UNIVERSITY IN SOUTHERN BRAZIL

ESTILOS DE APRENDIZAGEM DOS ESTUDANTES DA DISCIPLINA DE ENDODONTIA DE UMA UNIVERSIDADE PRIVADA NO SUL DO BRASIL

ESTILOS DE APRENDIZAJE DE ESTUDIANTES DE ENDODONCIA EN UNA UNIVERSIDAD PRIVADA DEL SUR DE BRASIL

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ABSTRACT: The learning styles of Endodontics students from an undergraduate Dentistry course were evaluated using the Felder-Soloman Learning Styles Index. 144 students participated, from the morning and night shifts, between May and June 2016. Of these, 80.6% were female and 68.5% of the morning shift. The average age was 22.94 years and the median grade in the discipline was 6.52. The predominant styles were sensory, visual, active and sequential, respectively. The correlation between age and shift, and the intensity of each learning style had no statistically significant difference ($p > 0.05$). Women were more sensory and men more visual ($p = 0.010$). In the correlation between the annual average and the styles, there was a significant difference for the sensory and the intuitive ($p < 0.001$). Most had a mixed preference between learning styles, regardless of the shift.

KEYWORDS: Learning. Endodontics. Teaching.

RESUMO: *Foram avaliados os estilos de aprendizagem dos estudantes de Endodontia de um curso de graduação em Odontologia, por meio do Índice de Estilos de Aprendizagem de Felder-Soloman. Participaram 144 estudantes, dos turnos matutino e noturno, entre maio e junho de 2016. Destes, 80,6% eram do gênero feminino e 68,5% do turno da manhã. A média*

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de idade foi de 22,94 anos e a mediana de notas na disciplina foi de 6,52. Os estilos predominantes foram sensorial, visual, ativo e sequencial, respectivamente. A correlação entre idade e turno, e a intensidade de cada estilo de aprendizado não tiveram diferença estatisticamente significativa (p > 0,05). As mulheres foram mais sensoriais e os homens mais visuais (p = 0,010). Na correlação entre média anual e estilos, houve diferença significativa para o sensorial e o intuitivo (p < 0,001). A maioria teve preferência mista entre os estilos de aprendizagem, independentemente do turno.

***PALAVRAS-CHAVE**: Aprendizagem. Endodontia. Ensino.*

***RESUMEN**: Los estilos de aprendizaje de los estudiantes de Endodoncia de un curso de pregrado en Odontología se evaluaron utilizando el índice de estilos de aprendizaje de Felder-Soloman. Participaron 144 estudiantes, de los turnos matutino y nocturno, entre mayo y junio de 2016. De estos, el 80,6% fueron mujeres y el 68,5% del turno matutino. La edad promedio fue de 22,94 años y la nota media en la disciplina fue de 6,52. Los estilos predominantes fueron sensorial, visual, activo y secuencial, respectivamente. La correlación entre la edad y el turno, y la intensidad de cada estilo de aprendizaje no tuvo diferencias estadísticamente significativas (p > 0.05). Las mujeres eran más sensoriales y los hombres más visuales (p = 0,010). En la correlación entre el promedio anual y los estilos, hubo diferencia significativa para el sensorial y el intuitivo (p <0,001). La mayoría tenía una preferencia mixta entre los estilos de aprendizaje, independientemente del cambio.*

***PALABRAS CLAVE**: Aprendizaje. Endodoncia. Enseñanza.*

Introduction

The learning process must be creative so that the student can become reflective and develop other intellectual skills, in order to learn to build knowledge, to be able to think about issues and, above all, to be able to express their ideas. Thus, currently there is a need and concern expressed by the search for how students learn.

In case the pedagogical activities are centered on the student and on the learning outcomes, the identification of learning styles is an important step towards the personalization of teaching. Styles refer to individualized preferences and tendencies, which directly influence the way of learning (ALMEIDA, 2010; SCHMITT; DOMINGUES, 2016). The characteristics are particular when acquiring knowledge, skills and attitudes, that is, each individual has a unique and differentiated style in the knowledge systematization process (DA SILVA, 2006). According to Lopes (2002), they derive from the concepts of typology and personality, and are related to the particular way of obtaining, retaining, processing and organizing knowledge.

The concept of style, in pedagogical language, is used to analyze various behaviors, that is, the way people act (ALONSO; GALLEGO; HONEY, 1999). According to Sadler-

Smith (1997), understanding and recognizing the concept of learning style are ways to help schools think more about their roles and the cultural organization in which teachers and students are inserted.

In an analysis of national production on social skills, Murta (2005) states that their formation is defined by multiple aspects, such as verbal and non-verbal movements, cognitive-affective, physiological and personal appearance. However, in the formation of social skills, failures can occur that cause expressive deficits, which are associated with poor academic performance (MURTA, 2005).

Attention to the socio-emotional needs of students must be considered for the construction of a motivating educational environment, especially on the part of teachers, as presupposed by Guimarães and Boruchovitch (2004). These authors assessed student motivation based on the teachers' motivational style, revealing that this is an important construct through the positive impact on student performance.

As the teacher becomes aware of the existence of different profiles, and that each student has their own way of learning and relating, selecting the most appropriate strategies for a particular type or group of students, they start to promote teaching guided by these parameters, using strategies that promote more effective and lasting learning (KURI, 2004).

It is known that the educational system is still very dependent on the teacher, the classroom and instructional techniques and resources. The teaching and learning process takes place through the interaction of the elements of an educational environment: institution, teacher, student and subject (DA SILVA, 2006). Fritsch, Flores and Giraffa (2008) understand that teaching strategies should include guiding functions in the performance of activities, explanations of phenomena and processes, corrections, as well as specific and individual adaptations, generating challenges, explanations, examples and/or counterexamples during interactions.

Here, learning styles come to the fore, once defined as the different ways of carrying out a process, as learning in a structured educational system involves two steps: receiving and processing information, which can be followed without an order specific achievement (FELDER; SILVERMAN, 1988). In this context, the Index of Learning Styles (ILS) emerges (FELDER; SOLOMAN, 1991), an instrument developed at the State University of North Carolina, which serves to determine the learning preferences in four dimensions of the Felder Model and Silverman (1988). The difference is that this instrument does not include the inductive/deductive dimension of the previous model.

The ILS addresses, in each dimension, two opposing learning styles: active/reflective, sensory/intuitive, visual/verbal and sequential/global (VIOLA *et al*., 2007). The instrument has 44 questions with only two choice options (alternative a or b). For each of the dimensions there are 11 questions. The difference between the scores of the pair of each dimension indicates which style is predominant or preferred by the respondent (FELDER; SOLOMAN, 1991).

Regarding the reliability and validity of the ILS, studies with positive results were found in several countries (FELDER; SPURLIN, 2005; HOSFORD; SIDERS, 2010; KU; SHEN, 2009), including in Brazil (KURI, 2004; LOPES, 2002).

Based on the above, the present study aimed to describe the profile of the learning style of students in the discipline of Endodontics, from the Undergraduate Course in Dentistry at Positivo University, Curitiba, Brazil.

Material and methods

This work is a cross-sectional, exploratory and descriptive study, which was approved by the Research Ethics Committee of Positivo University, under registration n. 2,045,917. All subjects were informed about the purpose of the study and signed the Informed Consent Form. To choose the sample, the non-probabilistic method of convenience was used, in which 179 students from the undergraduate course in Dentistry at Positivo University, aged 18 years or over, were invited to participate. Those who were regularly enrolled in the discipline of Endodontics during the period from May to June 2016, of both genders, and in the morning and night shifts were included.

The learning style was assessed using the ILS (FELDER; SILVERMAN, 1988) in a version validated for Portuguese (LOPES, 2002). This instrument consists of 44 objective questions and identifies the students' learning styles, which can be: active/reflective, sensitive/intuitive, verbal/visual, inductive/deductive and sequential/global. A link to access the electronic form (Google Forms®) was made available to students.

Data were tabulated and analyzed in SPSS version 21.0 (IBM Corp. Released 2012. IBM SPSS Statistics for Windows, Version 21.0. Armonk, NY: IBM Corp.). Initially, descriptive analysis was performed and then the Mann-Whitney and Spearman correlation tests were applied. The 5% significance level was adopted.

Results

144 students participated in the research (response rate = 78.2%). Females made up 80.6% (n = 116) of the sample; morning shift students accounted for the largest proportion, with n = 98 (68.5%). The general mean age was 22.94 years (SD ± 4.67); the median of grades in the subject was 6.52, with a minimum of 0.60 and a maximum of 8.60.

Table 1 shows the median values (minimum and maximum) of the responses given to the learning styles evaluated.

Table 1 – Learning styles of Endodontics students of the Undergraduate Dentistry Course at Positivo University, Curitiba PR, Brazil (n = 144)

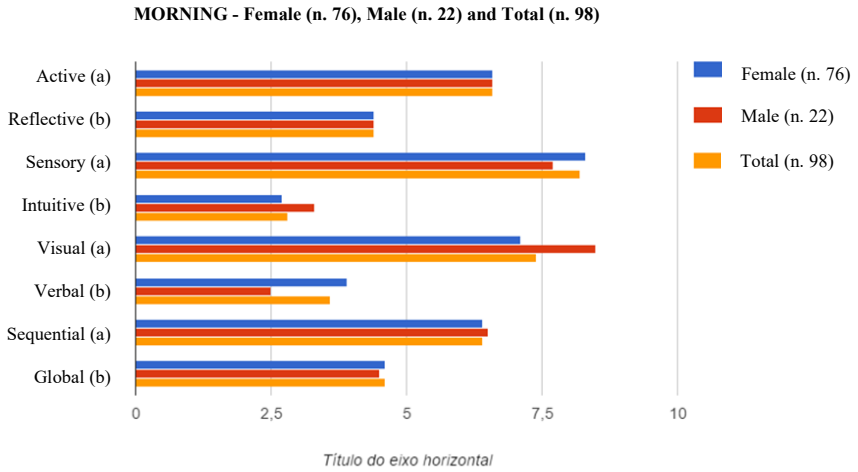
Learning styles	Median (min.-max.)
Active	6,48 (1-11)
Reflective	4,53 (0-10)
Sensory	7,98 (1-11)
Intuitive	3,05 (0-10)
Visual	7,25 (1-11)
Verbal	3,76 (0-10)
Sequential	6,27 (2-10)
Global	4,73 (1-9)

Source: Research data

It was noted that the profile of students was composed mostly of sensory, visual, active and sequential styles, respectively. It was also observed that, among the visual/verbal dimensions, there was visual domain, that is, most use the images more, whether in oral or written explanations (Table 1).

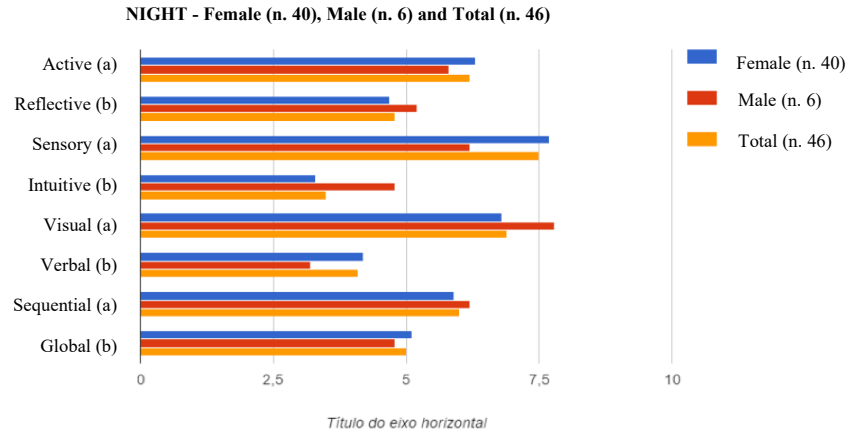
When analyzing the shifts, there was a predominance of the same styles: sensory, visual, active and sequential (Figures 1 and 2).

Figure 1 – Learning styles of students in the morning period of the Endodontics course of the Undergraduate Dentistry Course at Positivo University, Curitiba PR, Brazil (n = 144)



Source: Research data

Figura 2 – Estilos de aprendizagem dos alunos do período noturno da Disciplina de Endodontia do Curso de Graduação em Odontologia da Universidade Positivo, Curitiba PR, Brasil (n = 144)



Source: Research data

The correlation between the variable age and the intensity of each learning style did not reveal statistical significance ($p > 0.05$).

As for the association between gender and learning styles, the results are described in Table 2. Regardless of the shift in which the students are enrolled, the fact that, in general, women are more verbal and men are more visual regarding their preferred styles (Table 2).

Table 2 – Association between gender and learning styles of morning students of the Endodontics Discipline of the Undergraduate Dentistry Course at Positivo University, Curitiba PR, Brazil (n = 144)

Learning styles	Feminine median (min.-max.)	Male median (min.-max.)	p value*
Active	7 (3-10)	6 (1-11)	0,663
Reflective	4 (1-8)	5 (4-11)	0,655
Sensory	8 (4-11)	7 (1-11)	0,073
Intuitive	3 (0-7)	4 (0-10)	0,071
Visual	7 (1-11)	9 (4-11)	**0,010**
Verbal	4 (0-10)	2 (0-7)	**0,010**
Sequential	6 (2-10)	6 (3-9)	0,393
Global	5 (1-9)	5 (2-8)	0,391

* Mann-Whitney Test
Note: Values in bold are statistically significant
Source: Research data

In the Mann-Whitney test of association, when the shift and learning style variables were evaluated, no significance was found either ($p > 0.05$).

The correlation analysis between the annual average of students and the intensity of each learning style can be seen in Table 3. Here it can be stated that there was a statistically significant correlation between the annual average and the sensory and intuitive styles ($p < 0.001$)

Table 3 – Correlation between the annual average of the students and the intensity of the learning styles of the students in the morning period of the Endodontics discipline of the Undergraduate Dentistry Course at Positivo University, Curitiba PR, Brazil (n = 144)

Learning styles	p value*	Rs
Active	0,387	0,740
Reflective	0,387	0,740
Sensory	**<0,001**	0,312
Intuitive	**<0,001**	0,321
Visual	0,948	0,006
Verbal	0,948	0,006
Sequential	0,150	0,122
Global	0,150	0,122

* Mann-Whitney Test
Note: Values in bold are statistically significant
Source: Research data

Discussion

This study aimed to analyze the different learning styles among students of the Endodontics discipline of an Undergraduate Course in Dentistry, where a variation between

sensory, visual, active and sequential styles was revealed, regardless of class shift. Regarding gender, women adopt more sensory style, while men are more visual. The best annual grade point average was obtained by students who said they adopted the sensory and intuitive styles.

Certainly, each student develops strategies and has preferences as to how to receive, organize and retain information (DA SILVA, 2006). Such strategies can, in general, be called learning styles, which are defined as the modality preferred by the subjects to learn (ALMEIDA, 2010; SCHMITT; DOMINGUES, 2016). One learning style does not preclude the other; on the contrary, learning styles can complement each other. In fact, it is quite common to find style preferences among students. A survey conducted with individuals from different areas, including Dentistry, revealed that the predominant styles found, in descending order, were: sensory (76.19%), sequential (67.0%), verbal (57.7%) and active (56.7%) (BIRRER; MINELLO, 2016).

A study in which learning styles preferences were evaluated with engineering students was the one by Carmo *et al.* (2010). The authors concluded that the learning style of most respondents was active, which assumes that the curriculum and the teaching and learning process adopted by teachers promote or strengthen this fact. Students who prefer the active style apply concepts in practice after discussing the topics in groups. Perhaps this is an inherent characteristic of courses in which there is a need to think and develop projects collectively.

With Accounting students, research identified the prevalence of styles in the order: active, visual, sensory and sequential (DE SOUZA; AVELINO; TAKAMATSU, 2017; MENDES DA SILVA; DUTRA DE OLIVEIRA NETO, 2010). In turn, in Portuguese Administration students it was observed that they are more sensory (CARVALHO *et al.*, 2019).

In the health area, in research with 172 pharmacy students, the mean age was similar to that found here, with a value of 21.1 years and 75.4% were women. As for learning styles, sensory predominated (87.8%), followed by visual (69.8%) and sequential (61.6%), data that corroborate those found here in the first two positions (BECKER, 2013). In the pilot study, also with Pharmacy students, authors pointed out the same results of the present research, with a predominance of sensory, active and sequential perception (DE JESUS *et al*., 2017).

In the present research, the prevalent learning style was the sensory one, however, many students preferred the visual, active and sequential styles. The prevalence of the sensory can be explained by the context of study and learning of these students, who deal with facts

and real clinical cases, whereas the sensory ones prefer information perceived through the senses and tend to be methodical (CURY, 2000).

It is important to point out that the students evaluated in this research were studying the subject of laboratory Endodontics, and the tactile/sensory perception of an endodontic instrument exploring a root canal is essential for the success of endodontic therapy. Perhaps, more than any other specialty in Dentistry, the sensory learning style is extremely important for learning Endodontics.

Another relevant fact is that the practical profile of the Dentistry course itself requires a more detailed perceptive capacity from students, who end up being trained to develop their sensory capacity. This, in fact, is described in the sensory dimension of learning, which comprises those who like to learn from concrete cases, are more detailed, memorize facts easily, and do well in practical work (FELDER; SPURLIN, 2005). This was also found in a survey with students from the same course in the pre-clinical stage of surgery, with more respondents also claiming to be sensory (OMAR, 2017).

The second most prevalent learning style among students who participated in this research was visual. Students who choose this style prefer that information be passed on to them through diagrams, flowcharts, figures, illustrations, films or any other means of visual representation (FELDER; FELDER; DIETZ, 2002). Regarding the peculiarities of each Course, it is intuitively plausible that Dentistry students fit better in the visual style. This idea is not new and, in previous research carried out with orthodontic students, it was found that they are highly visual learners, but with a preference for sequential and sensory learning strategies (HUGHES *et al.*, 2009). In the present study, it was observed that in the visual/verbal dimension there is dominance of the visual style, that is, most take greater advantage of images, whether in oral or written explanations. In this sense, the use of oral or written explanations can occur, but images, diagrams, tables and graphs should not be left out during the explanations, as they, by themselves, will not contribute so effectively to the majority (FELDER; SPURLIN, 2005).

In the active dimension, it can be said that there was a balance between students who understand better when they discuss or explain to other people. Finally, the sequential dimension indicates that students prefer logical paths, learn better the contents presented in a linear and linked way (FELDER; SPURLIN, 2005).

In this research, it was also evidenced that women adopt a predominantly verbal style, a fact also pointed out in a study carried out with undergraduate students of the Dentistry course (LIMA, 2007). A slightly deeper explanation for women's predilection for verbal style

refers to the fact that, for most of them, verbal communication is essential for understanding facts and for developing a good interpersonal relationship (WOOD, 1995). Thus, it is not surprising that women point to and adopt the verbal learning style as the main form of learning. From a pedagogical point of view, verbal students prefer to hear information (CURY, 2000).

In general, any learning process must involve four basic processes: perception, retention, processing and organization of information (SILVA *et al*., 2012) and, in this research, a relevant data concerns the perception of information by students and which involves the sensory dimension and the intuitive dimension. Sensory and intuitive students were those who obtained better grades in the period of data collection. The main characteristics observed in sensory students are attention to details, attention to the method itself; intuitive students, on the other hand, see new possibilities and are therefore innovative.

Final considerations

This study provides evidence that the information perception process and the way the student processes it is very similar to the learning style that involves the sensory and intuitive dimensions. This fact can serve as a subsidy for teachers to think about better targeted strategies and methodologies.

Obviously, the pedagogical approaches and individual differences of each student will also influence the learning style. From this perspective, teachers must use strategies compatible with the needs of students. On the other hand, individual differences that are determined by a series of factors, including affective components, personality, emotional characteristics related to persistence, responsibility, motivation and peer interaction, must be carefully evaluated. Thus, it is possible to infer that knowledge of individual and predominant learning styles in a class can bring benefits to students and teachers. To students who, by becoming aware of how they learn better, can further develop these skills and thus can learn more, better and faster; teachers, once knowing the predominant learning styles in a given class, can adapt their teaching and learning processes to match these characteristics, but without neglecting the multiple existing styles.

The instrument used here was able to assess the students' learning style and is recommended because it can benefit them and teachers and, thus, contribute to the improvement of the teaching and learning process.

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