

Learning styles of health professions undergraduate students from a single institution

Estilos de aprendizagem de estudantes de graduação de diferentes profissões da saúde de uma instituição

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ABSTRACT

Introduction: The concept of “learning styles” derives from theories postulating that students learn by following diverse pathways and that learning is more effective when the adopted teaching strategies more closely match specific student characteristics and learning preferences.

Objectives: To determine, in first-year students attending different undergraduate courses in the health area at the same higher education institution, the frequency of different learning styles, categorized according to the four dimensions of Felder & Soloman (FS) model, and to detect any differences associated with the type of course and gender.

Method: The study population (N=283; 190 women) consisted of first-year students attending the Medicine, Biomedical Sciences, Physical Therapy, Speech-Language Pathology, Nutrition and Metabolism, and Occupational Therapy courses, with 68.2% of them aged between 18 and 20 years. The students answered a sociodemographic characterization questionnaire and the FS Index of Learning Styles (ILS) questionnaire, which allowed determining the frequencies of the different learning styles and their associations with the type of undergraduate course and gender.

Results: the student group showed a predominance of “Sensory”, “Visual”, “Reflective” and “Sequential”, learning styles, in the “Perception”, “Input”, “Processing” and “Understanding” dimensions of learning, respectively. There was no statistically significant difference in terms of learning styles, in any of the dimensions, that could be associated with the type of course and gender, although women showed a significant predominance of the “Reflective” style in the “Processing” dimension.

Conclusion: It was not possible to establish significant differences between the different undergraduate courses in the health area, or between men and women, regarding the students’ predominant learning styles, although women showed a significantly higher frequency of the Reflective style. These findings must be considered when planning learning activities and, mainly, in pedagogical support, giving students the opportunity to learn about their learning styles and helping them to better adapt to the strategies employed in each institution.

Keywords: University; Education, Higher; Learning, styles; Cognition; Students, Health Occupations.

RESUMO

Introdução: O conceito de estilo de aprendizagem deriva de teorias que consideram que as pessoas aprendem de maneiras diversas e que esse processo é melhor quando as estratégias de ensino e aprendizagem adotadas no ambiente escolar são mais compatíveis com algumas das suas características.

Objetivo: Este estudo teve como objetivos determinar, em estudantes ingressantes na mesma instituição de ensino superior, em vários cursos de graduação na área da saúde, a frequência dos diferentes estilos de aprendizagem, categorizados segundo as quatro dimensões do referencial de Felder e Soloman (FS), e detectar eventuais diferenças associadas ao tipo de curso e ao gênero.

Método: A população de estudo (N = 283; 190 mulheres) foi composta por ingressantes dos cursos de Medicina, Ciências Biomédicas, Fisioterapia, Fonoaudiologia, Nutrição e Metabolismo e Terapia Ocupacional, com 68,2% deles com idade entre 18 e 20 anos. Os estudantes responderam a um questionário de caracterização sociodemográfica e ao Inventário de Estilos de Aprendizagem (ILS) de FS, que permitiu determinar as frequências dos vários estilos de aprendizagem e as suas relações com o tipo de curso de graduação e o gênero.

Resultado: No conjunto de estudantes, houve predomínio dos estilos de aprendizagem “sensorial”, “visual”, “reflexivo” e “sequencial” nas dimensões “percepção”, “entrada”, “processamento” e “compreensão” da informação, respectivamente. Não houve, em nenhuma das dimensões, diferença estatisticamente significativa quanto aos estilos de aprendizagem que pudesse ser associada ao tipo de curso e ao gênero, embora as mulheres tenham apresentado significativo predomínio do estilo “reflexivo” na dimensão do “processamento”.

Conclusão: Não foi possível estabelecer diferenças significativas entre os vários cursos de graduação das profissões da saúde, nem entre homens e mulheres, quanto aos estilos de aprendizagem predominantes nos estudantes, embora as mulheres tenham apresentado frequência significativamente maior do estilo reflexivo. Esses achados devem ser levados em consideração no planejamento das atividades de aprendizagem e, principalmente, no apoio pedagógico, dando oportunidade aos estudantes de conhecer os seus estilos de aprendizagem e ajudando-os a se adaptar melhor às estratégias empregadas em cada instituição.

Palavras-chave: Universidades; Educação superior; Estilos de aprendizagem; Cognição; Estudantes de Ciências da Saúde.

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INTRODUCTION

The learning theories generically belong to two main currents, one that conceives learning as a mechanical process of association of stimuli and responses determined by external conditions ("associationism" theories, including classical and instrumental or operant conditioning) and another current, which considers the peculiarities of the person's internal structure¹. This approach includes constructivist and social learning theories, the modeling or imitation conditioning, cognitive theories, genetic-dialectical psychology and information processing theory¹.

The concept of learning style comes from theories originating in the second current, which postulate that people learn differently and that learning is more effective when the employed teaching strategies and the educational environments where they are found are more compatible with their specific modes of operation in the presence of the learning objects¹⁻³. Within this concept, the learning style in the educational field refers to a set of cognitive, affective and physiological indicators, supposedly stable ones, which determine how students perceive, interact with and respond to new information and new contents and to the different variables of the learning environments¹⁻³. It constitutes the way through which the individual prefers to learn and feels better in learning activities, which, in turn, reflect their characteristics, and may therefore be related to the way their mind processes and incorporates new information¹⁻³.

The term "learning style" was originally coined by Dunn in 1960 to refer to the different ways through which people learn⁴. Since then, several models of learning styles have been proposed and, correspondingly, several instruments have been developed for their characterization in students⁵. Among these, the ones known as "VARK" (Visual, Aural, Reading, Kinesthetic)^{5,6}, Kolb^{5,7} model, Dunn & Dunn⁸ model and the "ILS" (Index of Learning Styles) questionnaire, developed by Felder and Soloman⁹, stand out, based on the work by Felder and Silverman¹⁰.

The instruments for characterizing learning styles have been widely used in several countries and in different contexts, with different purposes, but, possibly, the main relevance of this line of work is to make teachers and students aware of the types and profiles of the prevalent learning styles, aiming to enhance the use of teaching strategies, recognizing the wealth of diversity and the plurality in educational and study contexts and learning^{5,9-11}.

In Brazil, since the publication, in the beginning of this millennium, of the National Curriculum Guidelines (DCN, *Diretrizes Curriculares Nacionais*) for undergraduate courses, there has been a constant effort to establish policies, strategies, technologies and organizational arrangements that contribute

more effectively to students' individual and collective learning, so they acquire the necessary skills and competences to meet the demands of society. Therefore, the pedagogical projects of the different careers or courses have envisioned the greater involvement of students in their own learning, through the use of more active methods. Hence comes the idea that the knowledge of students' learning styles should help them, as well as the institutions and teachers, to use more appropriate and, therefore, more effective learning resources.

On the other hand, although several studies have been carried out in Brazil to characterize the learning styles of higher education students from different areas, including health (for instance: Nursing, Pharmacy, Physical Therapy, Medicine and Psychology)¹²⁻¹⁶, studies on the different courses at the same institution are scarce. Based on the above and seeking to contribute to the knowledge on this topic, the main objective of this study was to determine the frequency of different learning styles, using the ILS instrument by Felder & Soloman⁹ in first-year students attending different undergraduate courses in the health area at the same institution. In addition to characterizing possible differences associated with career choice, understood as the type of undergraduate course, an attempt was also made to verify whether there are differences associated to the students' gender.

METHODS

Type of study

This was a descriptive, exploratory, cross-sectional study, involving the quantitative analysis of data that were routinely collected by a specific educational and psychological support center of the same public teaching and research institution, located in the interior of the state of São Paulo, the Ribeirão Preto Faculty of Medicine, University of São Paulo, which offers seven undergraduate courses in the area of health (Biomedical Sciences, Physical Therapy, Speech-Language Pathology, Biomedical Informatics, Medicine, Nutrition and Metabolism and Occupational Therapy). The analyzed data and studies of relations and associations were carried out in a sample of first-year students from the years 2020 and 2021.

Ethical aspects

The study project was initially authorized by the aforementioned support center and also by the collegiate responsible for managing the institution's courses, before being submitted to the institutional Research Ethics Committee (REC), with a request for waivers of the free and informed consent term, as this is a retrospective study of analysis of data that had already been obtained. After due analysis, the project was approved by the REC (under CAAE

53667421.7.0000.5440). Before sending the data to the researchers, they were all coded so that, at all stages of the study, they could be treated anonymously.

Study population

The study population consisted of 283 students from six of the seven courses offered by the institution. These students constitute a convenience sample, consisting of those who effectively answered the study instrument. Nevertheless, its representativeness is suggested by the fact that it was possible to obtain data at proportions ranging from 37% (Medicine) to 100% (Biomedical Sciences and Nutrition and Metabolism) of the eligible students. The undergraduate course in Biomedical Informatics did not have students participating in this study, because the number of first-year students who answered the main instrument was very small.

Data collection

In recent years, the institution, through its educational and psychological support center, started a longitudinal study on the characteristics of its students¹⁷, which consists in the periodic and regular application of several instruments, including the ILS, aimed at characterizing the styles of learning. Students participate voluntarily, after being informed of the importance of these data for the educational planning of the institution. These data are identified so that the longitudinal follow-up can be carried out, with the application of the same instruments at other moments throughout the course¹⁷. However, as mentioned before, for the purposes of this study, these data were coded in order to allow their analysis under conditions of complete anonymity.

Instrument

The automated electronic version of the ILS was used, originally translated into Brazilian Portuguese at São Carlos Engineering School of University of São Paulo by Nídia Pavan Kuri and Marcius F. Giorgetti¹⁸. This version was built based on the inventory by Felder and Soloman⁹, which is available in English with free access and without charge for its use in a specific website⁹. The original English version was tested for validity and reliability in different parts of the world¹¹ and the Brazilian Portuguese version used in this study was also submitted to validation studies in at least two different centers^{18,19}.

In the original model proposed by Felder & Silverman¹⁰, learning, from the point of view of the cognitive domain, would comprise five stages or dimensions, called "Perception", "Input", "Processing", "Understanding" and "Organization", with the latter being suppressed in the construction of the learning styles inventory⁹. For each one of the four dimensions included in the

ILS, the existence of two different styles was proposed, based on their different and antagonistic characteristics. The "Perception" dimension comprises the "Sensory" and "Intuitive" styles, the "Input" dimension encompasses the "Visual" and "Verbal" styles (also called "Auditive"), whereas the "Processing" dimension includes the "Active" and "Reflective" styles and the "Understanding" dimension includes the "Sequential" and "Global" styles.

The ILS instrument comprises 44 questions that correlate, in four groups of 11 questions, respectively, to four subscales, each corresponding to one of the dimensions proposed by the authors⁹. Each of the 11 questions must be answered in a dichotomous way, that is, choosing one or the other of the two provided alternatives.

For each set of 11 questions constituting each subscale and corresponding, therefore, to a given dimension, the scoring of the answers allows classifying the respondent into each of the two styles of that dimension (for instance, "Sensory" or "Intuitive"; or else "Visual" or "Verbal") and, additionally, assigning three degrees of intensity to each style⁹ (1 to 3 - balance; 5 to 7 - moderate; 9 to 11 - strong).

Data analysis

Descriptive statistics (analysis of frequency) was used to determine the distribution profiles of learning styles. The chi-square test was used to determine the associations between learning styles and type of undergraduate course or gender. The two-tailed Fisher's exact test was used to determine the differences between the proportions verified in the groups constituted by course and gender. The significance level was set at 5%. The statistical calculations were performed using the SPSS program (Statistical Package for Social Sciences, IBM - International Business Machines Corporation, v. 19).

RESULTS

Participants' characteristics

Regarding the demographic data of the study population, the number of women (N=190) was greater than that of men (N=92) and the highest concentration of students was in the 18-20 years age group (68.2 %), with few students over the age of 30 years (2.5 %).

The frequency distribution of students' genders, according to the course in which they are enrolled, is shown in Table 1. With the exception of the medical course, in which the distribution between men and women participating in the study was similar, with a slight predominance of men, the other courses had a higher percentage of women than men. One medical student did not indicate gender and, as a result, the total percentage of students was 98.7%.

Learning styles

The results related to the total number of students and the frequency distribution of learning styles, by dimension and by course, are shown in Table 2. In the analysis of the total sample of students, it was observed that a statistically significant majority preferred the *Sensory*, *Visual*, *Reflective* and *Sequential* learning styles.

There was no significant difference related to the type of course regarding the frequencies of the learning styles preferred by the students in any of the dimensions, in the joint comparative analysis between the six courses in the four dimensions, although variations from course to course were detected in one or another (Table 2).

Figure 1 shows that, considering the total sample of students included in the study, for all eight styles in the four dimensions, there was a clear predominance of the balanced intensity range, with the exception of the *Sensory* style, in the *Perception* dimension, in which there was a predominance of moderate intensity. When comparing the different frequency ranges, no statistically significant differences were observed for any of the styles among the students from the different courses. (Fig. 1).

Figure 2 shows that, for the total sample of students, there were no significant differences between the female and male gender regarding the learning styles preferred by the study participants, in any of the dimensions, although women showed a significantly greater preference for the *Reflective* style.

Table 1. Distribution of study participants by gender and course of origin

Courses	Total	Female		Male	
		N	%	N	%
Biomedical Sciences	45	32	71,1	13	28,9
Physical therapy	42	33	78,6	9	21,4
Speech therapy	37	33	89,2	4	10,8
Medicine	78	34	43,0	44	55,7
Nutrition and metabolism	47	31	66,0	16	34
Occupational therapy	33	27	81,8	6	18,2
Total	282*	190	67,4	92	32,6

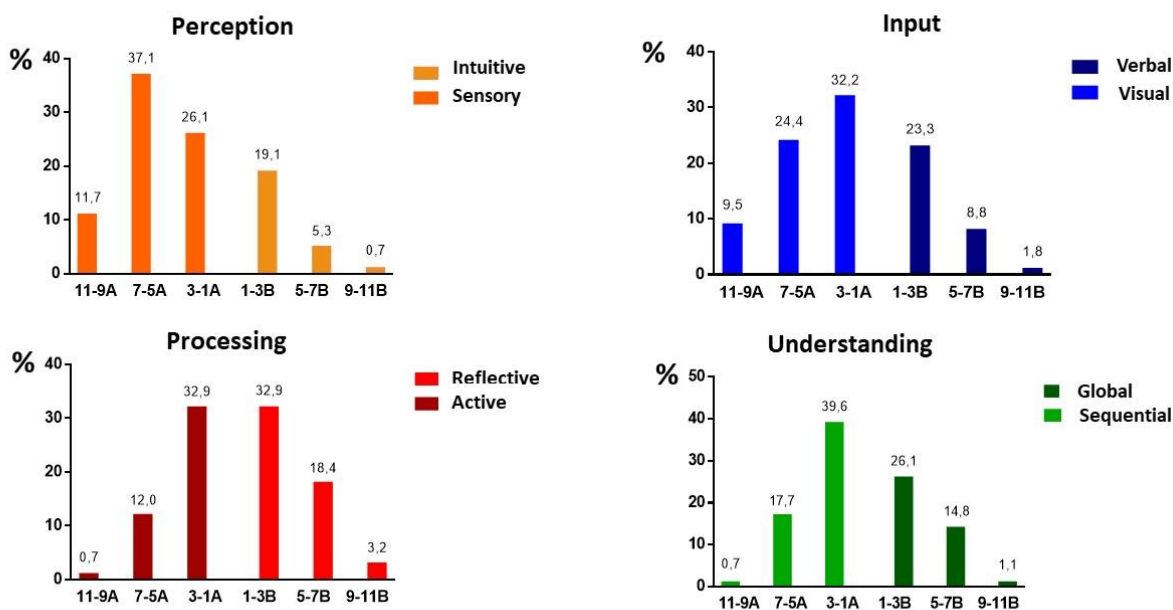
N - Number of participants; (*) - one student did not answer the question about gender.
Source: prepared by the authors.

Table 2. Numbers and, between parentheses, percentages of students from different courses in the institution's health area according to the learning styles characterized by the Felder and Soloman ILS instrument, in its four dimensions. There was no significant difference related to the type of course regarding the learning styles preferred by students in any of the dimensions

Courses (N)	Dimensions							
	Perception		Input		Processing		Understanding	
	Sensory	Intuitive	Visual	Verbal	Active	Reflective	Sequential	Global
Biomed. Sci. (45)	36 (80,0)*	9 (20,0)	25 (55,6)	20 (44,4)	17 (37,8)	28 (62,2)*	26 (57,8)	19 (42,2)
Physical Therapy (42)	31 (73,8)*	11 (26,2)	32 (76,2)	10 (23,8)	17 (40,5)	25 (59,5)	22 (52,4)	20 (47,6)
Speech-Language Pathology (37)	27 (73,0)*	10 (27,0)	25 (67,6)	12 (32,4)	19 (51,4)	18 (48,6)	21 (56,8)	16 (43,2)
Medicine (79)	58 (73,4)*	21 (26,6)	54 (68,4)	25 (31,6)	34 (43,0)	45 (57,0)	45 (57,0)	34 (43,0)
Nutrition (47)	42 (89,4)*	5 (10,6)	31 (66,0)*	16 (34,0)	26 (55,3)	21 (44,7)	31 (66,0)*	16 (34,0)
Occupat. Therapy (33)	18 (54,5)	15 (45,5)	20 (60,6)	13 (39,4)	16 (48,5)	17 (51,5)	19 (57,6)	14 (42,4)
Total (283)	212 (74,9)*	71 (25,1)	187 (66,1)*	96 (33,9)	129 (45,6)	154 (54,4)*	164 (57,9)*	119 (42,1)

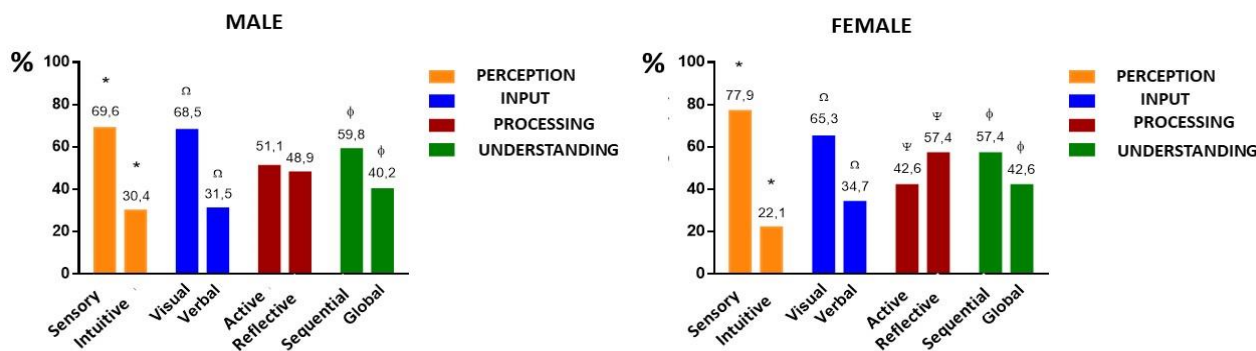
(N) – total number of participants per course. The asterisk (*) depicts the predominant learning styles, that is, the ones with a significantly higher frequency ($p < 0.05$) than the other in the same dimension; in the total sample, the predominant styles were *Sensory* ($\chi^2 = 140.502$; $p < 0.0001$; Contingency coefficient: 0.446), *Visual* ($\chi^2 = 58.523$; $p < 0.0001$; Contingency coefficient: 0.306), *Reflective* ($\chi^2 = 4.417$; $p < 0.05$; Contingency coefficient: 0.088) and *Sequential* ($\chi^2 = 14.311$; $p < 0.0001$; Contingency coefficient: 0.157).
Source: prepared by the authors.

Figure 1. Percentage of the total sample of students (N = 283) at the institution in different ranges of intensity of learning styles for each dimension of the Felder and Soloman model.



Intensity ranges: balance (3-1A and 1-3B); moderate (7-5A and 5-7B); strong (11-9A and 9-11B).
Source: prepared by the authors.

Figure 2. Percentage of the total sample of female or male gender students (N=282) regarding the learning styles of each of the dimensions in the Felder and Soloman model. There were no statistically significant differences between male and female students in any of the dimensions, despite the higher frequency of the Reflective style among women.



* - $p < 0.05$, between learning styles in the "Perception" dimension, Ω - $p < 0.05$ between learning styles in the "Input" dimension, Ψ - $p < 0.05$, between learning styles in the "Processing" dimension and Φ - $p < 0.05$ between learning styles in the "Understanding" dimension. One student did not state their gender, which is why the number (N) of this sample is lower than the total number of participants (N=283).
Source: prepared by the authors.

DISCUSSION

Our results show that, in the sample of first-year students from six undergraduate courses in the health area at the same public higher education institution, evaluated according to the ILS instrument developed by Felder and Soloman⁹, the *Sensory*, *Visual*, *Reflective* and *Sequential* learning styles predominate, without significant differences between the courses. However,

in some of them, such as Physical Therapy, Speech-Language Pathology and Medicine, there was a significant difference only in favor of the Sensory style (vs. Intuitive), and in the other dimensions, similar proportions were found in the other styles. Moreover, in the Occupational Therapy course, the frequencies of the eight styles, in the four dimensions, were similar, with no significant differences between them.

In the whole set of students from the six courses, with the exception of the Sensory style, in which the moderate intensity range was more frequent, the balanced intensity range predominated for the other styles.

In the analysis of the frequency of the learning styles in the group of students, stratified by gender, a significantly higher proportion of women was found in the Reflective style; however, there were no significant differences between women and men in terms of the frequency of any of the learning styles in the total sample.

The sample of assessed students can be considered representative of those entering the institution, which offers a higher number of annual vacancies (N=100) for the medical course and a smaller number (ranging between 20 and 40 vacancies) for the other courses, also showing a greater prevalence of women in the different courses, when compared to Medicine²⁰.

Although there are individual studies in specific groups of Brazilian students from courses in the health area, using different instruments, the relative scarcity of research using the ILS instrument and involving different courses makes it difficult to compare their results. Becker¹⁴, applying the ILS in a sample of 192 Pharmacy students at the Federal University of Sergipe (143 women), found a predominance of Sensory (87.8%), Visual (69.8%) and Sequential (61.6%) styles, disclosing results and proportions that are similar to ours. Differently, however, Becker¹⁴ found a predominance of the Active style (59.5%) in the "Processing" dimension (vs. Reflective), but this dimension was the one that, as in the present study, showed the smallest differences between the frequencies of the two styles. As in the present study, Becker¹⁴ did not find any differences regarding the frequencies of learning styles between female and male students.

Although using methods that were slightly different from those adopted in the present study, Olímpio et al.¹⁶ also found a predominance of the Sensory, Visual, Reflective and Sequential styles in a sample of 46 Nursing students (38 women) from a public institution in the interior of the state of São Paulo.

In a study with 97 multiprofessional health residents from different professions in the health area (Nursing, Physical Therapy, Speech-Language Pathology, Social Work, Psychology, Pharmacy, Physical Education, Dentistry, Occupational Therapy and Nutrition, Birrer and Minello¹⁵ found, as in our study, a predominance of the Sensory and Sequential styles, but, unlike the present work, a predominance of the Verbal (vs. Visual) and Active (vs. Reflective) styles. However, the frequency differences favoring the Sensory and Sequential styles were also much greater than those found in relation to the Verbal and Active styles. As in our study, only the Sensory style predominated at

the moderate intensity range, while the other prevalent styles were in the balanced intensity range.

The data from our study suggest the absence of significant and important differences between the different courses or careers in the health area at the same institution. When analyzed in comparison with the results of the other abovementioned studies, which investigated students^{12,14,16} or professionals¹⁵ in the health area, they suggest that the Sensory and Sequential styles were predominant in all of them. There is no evidence, however, that these preferences related to learning styles are specific to the health area.

This is shown by Kuri¹⁸, in his pioneering study with the ILS in 840 students from four different Engineering careers, who verified a clear predominance of the Sensory, Visual, Active and Global styles in all of them. In turn, Lopes¹⁹, studying a sample of 235 undergraduate students from courses in the area of Humanities (89% women) and 214 students from courses in Exact Sciences (21% women) with the ILS, found few differences between the two groups, detecting a predominance in both of the Sensory, Active, and Sequential styles. The main differences were the greater preference for the Verbal style in the Human Sciences and the Visual style in the Exact Sciences, and also the lower differences between the two styles for each dimension in the group of Human Sciences. In both groups and for all styles, there was a predominance of the balanced intensity range, with the exception of the Sensory style in the group of Exact Sciences, in which the moderate intensity predominated.

In another study with the ILS, Santos and Mognon¹³ investigated the learning styles in a sample of 242 university students from courses in the areas of Human Sciences (Literature, Pedagogy and Administration), Exact Sciences (Architecture, Mechanical Engineering and Information Technology) and Health Sciences (Physical Therapy and Physical Education), with a slight predominance of male over female students. Among the students, the Sensory, Visual, Active and Sequential learning styles predominated. Comparing by gender, men showed a higher frequency of preference for the Visual (vs. Verbal) style than women. There were no significant differences between the courses, except for the higher frequency of Verbal (vs. Visual) and Reflective (vs. Active) styles in the Literature course and Verbal style in the Pedagogy course.

Therefore, the analysis of our results, together with the aforementioned Brazilian studies that also used the ILS instrument in characterizing the learning styles of undergraduate students, suggests that there is not a combination of styles that is specific to the institution or area of training (Human, Exact or Health sciences), to course or career or gender, with an emphasis, however, on the predominance in

all studies, without exception, of the Sensory style, which may be associated with the search for training in higher education.

In the present cross-sectional study, we characterized the prevalent learning styles in a sample of students starting higher education, without having elements on the stability of the findings. Felder & Silverman¹⁰, in their original proposition, allude to the overlap between learning styles and personality types, which makes one presuppose that they are stable. Although there are few studies in which students were followed throughout the course, Hosford and Siders²¹, studying six consecutive classes of medical students (N=385) over four years, found significant stability in the styles found during the first application of the ILS. Similarly, although it was not a study with a prospective longitudinal design, Kuri¹⁸ did not find any differences between students at the beginning (1st year) and at the end (5th year) of Engineering courses.

In our study, as in many of those mentioned, with the exception of the Sensory style, there were small differences between the proportions of students in the two styles of the same dimension, who fell in the range of balanced intensity. These facts, especially the balanced intensity, may indicate that students' preferences may be relative, depend on circumstances and, therefore, do not prevent students from adapting to stimuli and the environment, to favor learning. In this sense, it is appropriate to mention the study by Alghasham²², which accompanied two groups of students with different styles (Active and Reflective) in problem-based learning activities and verified that, despite exhibiting different behaviors and using different study strategies, they showed similar performances in the formative evaluation at the end of the process, which, indirectly indicates the student's search for adaptation.

The choice in this study for the ILS instrument, referenced in the studies by Felder and Soloman⁹ and Felder and Silverman¹⁰, was essentially a pragmatic one, as it was already being used in our institution and in others of the same university, as well as the fact -that it was available for automatic application, which allows obtaining the results quickly. In addition, among the several models of proposed learning styles, it seems to be the only one that considers the important influences on learning linked to environmental, emotional, physiological and psychological factors, as highlighted by Schmitt and Domingues⁵, in an interesting comparative review of the different models of styles of learning. The model by Felder et al.^{9,10} additionally shares the Active and Reflective styles with the Kolb model⁷ and the Visual and Verbal elements with the "VARK" model^{15,6}.

However, it should be noted that, despite the theories that support the concept of learning styles¹⁻³, the large number of propositions for classifying the styles⁴⁻¹⁰, many with the

corresponding instruments for their characterization, as well as the large amount of studies on this topic published in recent decades, the meaning of findings, such as those of our study, is uncertain. It is particularly doubtful whether one or the other learning style can be predictive of good or bad academic performance. In a review of 31 studies on the learning styles of students from different health professions, including Medicine, Nursing and Pharmacy²³, in which an attempt was made to determine the relationship between learning styles and academic performance, the findings showed weak or non-existent correlations. In this search for the meaning of learning styles, another extensive systematic review of articles on predictive factors of academic failure in medical students²⁴ found studies that explored several causes, including learning styles. However, there was no consistency among the five studies, in which it was postulated that specific styles could be associated with the outcome of interest, while two of the studies did not find any evidence that one or another style in particular could be predictive of academic failure²⁴.

On the other hand, an investigation carried out in India, with hundreds of students from several university courses, using the ILS instrument, verified that students with the Visual and Active styles were better able to deal with stress, which can have a positive influence on the academic performance²⁵.

Together with the conflicting or negative results on the relationships between learning styles and success or failure outcomes in academic performance, it is also possible to point out the existence of more than 10 different models, which are not always convergent, of learning styles as a difficulty in this field of study⁵. Most models of learning styles have their corresponding instruments for characterizing them in the student population, but concrete evidence of their quality, in terms of validity and reliability, is scarce²⁶.

These considerations make it easier to understand why there is strong criticism of the very existence of the construct underlying learning styles. For instance, Riener and Willingham²⁷ even use the word "myth" (in the sense of "legend") when criticizing concepts related to learning styles. While acknowledging that people are effectively different from each other in the way they learn, which can affect individual learning, they question the concept that learning could be improved if teaching strategies more appropriate to their styles were used. This criticism, according to these authors²⁷, is based on the fact that there are no empirical demonstrations or controlled experimental studies that can support this concept and, also, on the proven existence of a diversity of factors, such as motivation, interests and specific and individual aptitudes, which may, perhaps, even more strongly influence each person's learning. As for us, as education professionals working

in the health area, we can add the criticism that, although the concept of learning style can be applied to the acquisition of knowledge, it is uncertain whether it equally applies to the development of professional skills and competences, the incorporation of attitudes and values of professional life, as well as the construction of a professional identity, attributes of utmost importance in the health area.

Regarding the practical usefulness of knowing the students' styles to better program teaching, Felder & Silverman¹⁰ already stated that teachers should be aware of the diversity that can be found in any group of students, so they can use a variety of teaching and learning strategies that encompass the many possibilities of style combinations prevalent in classes with many students. However, even though at our institution we try to make course coordinators aware of the learning style profiles that are prevalent among students, the hypothesis that such will result in a rearrangement of instructional methods and learning strategies still lacks studies to substantiate it and we did not find any published studies on this topic.

In any case, at our institution, we regularly use the characterization and monitoring of the students' learning styles in the different courses¹⁷ and there is definitely a positive experience in conducting workshops aimed at information and self-knowledge of students' learning styles, so they can better adapt to the different teaching strategies and build more productive study plans²⁸. As a consequence of participating in these workshops, students report better self-knowledge about their learning process and about which resources could be useful in overcoming difficulties, particularly in the first years of the undergraduate course²⁸, in addition, student participation in the workshops contributes to the construction of collaborative networks among them, favoring their adaptation to the university environment²⁸. In this sense, it is interesting to mention that in the aforementioned review of studies seeking to determine the relationship between learning styles and academic performance²³, no studies were found exploring self-awareness, a component of the so-called "emotional intelligence", which has been considered an important attribute to be acquired by health professionals^{23,29}.

It is important to consider that the present study has several limitations, such as being restricted only to the characterization of the learning styles prevalent in the first-year students of the different undergraduate courses of health professions, in a single institution, using a cross-sectional design. As this is a first exploratory study, which was carried out with data that had been previously collected as the main material, it was not possible to investigate the association with other variables, such as previous education, socioeconomic data and study habits. However, some of these limitations can be addressed in future studies,

among which the most feasible are the longitudinal follow-up of the learning style profiles of first-year students and whether self-awareness about styles reflects on improved academic performance. In any case, the true meaning for each student of their learning style profile and their relationship with other academic outcomes in the context in which they are inserted remains a point to be further investigated.

FINAL CONSIDERATIONS

When applying the ILS learning styles inventory by Felder and Soloman⁹ to a representative sample of first-year students from six undergraduate courses in the health area at the same public university institution showed us a significantly high frequency of *Sensory* (vs. *Intuitive*), *Visual* (vs. *Verbal*), *Reflective* (vs. *Active*) and *Sequential* (vs. *Global*) styles. It was not possible to establish significant differences between the different undergraduate courses in the health professions, or between the male and female genders, regarding the students' predominant learning styles, although women showed a significantly higher frequency of the *Reflective* style. These findings should be taken into account when planning learning activities and, mainly, in pedagogical support, giving students the opportunity to learn about their learning styles, which can help them better adapt to the strategies employed in the institution.

AUTHORS' CONTRIBUTION

Susana Quirós Cognuck, Rodrigo Humberto Flauzino, Lucila Leico Kagohara Elias and Luiz Ernesto de Almeida Troncon participated in the design and planning of the study, analysis and interpretation of data, and the drafting and review of the manuscript. Susana Quirós Cognuck and Rodrigo Humberto Flauzino participated in data collection. Susana Quirós Cognuck performed the statistical analysis of the data, the creation of the illustrative material (tables and charts) and the drafting of the first version of the manuscript.

CONFLICTS OF INTEREST

The authors declare no conflicts of interest.

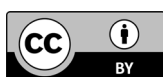
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