# Comparative analysis of learning styles among students in preparatory programs for higher education entrance exams: general course versus medical-specific course

# Análise comparativa dos estilos de aprendizagem de estudantes de programas preparatórios para exames de admissão no ensino superior: curso geral versus curso específico para medicina

# Análisis comparativo de los estilos de aprendizaje de estudiantes en programas preparatorios para exámenes de admisión a la educación superior: curso general versus curso específico para medicina

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**Ewerton Alexandre Galdeano**
PhD candidate in Health Sciences
Institution: Faculdade de Medicina de Jundiaí (FMJ)
Address: Jundiaí, São Paulo, Brazil
E-mail: ra2103025@g.fmj.br

**Gilmar Cardozo de Jesus**
PhD in Science and Mathematics Education
Institution: Faculdade de Medicina de Jundiaí (FMJ)
Address: Jundiaí, São Paulo, Brazil
E-mail: ra2203031@g.fmj.br

**Rogerio Leone Buchaim**
PhD in Health Sciences
Institution: Faculdade de Odontologia de Bauru da Universidade de São Paulo (FOB - USP)
Address: Bauru, São Paulo, Brazil
E-mail: rogerio@fob.usp.br

**João Paulo Mardegan Issa**
PhD in Medical Sciences
Institution: Faculdade de Odontologia de Ribeirão Preto da Universidade de São Paulo (FORP - USP)
Address: Ribeirão Preto, São Paulo, Brazil
E-mail: jpmissa@forp.usp.br

**Daniela Vieira Buchaim**
PhD in Applied Dentistry Sciences
Institution: Faculdade de Odontologia de Bauru da Universidade de São Paulo (FOB - USP)
Address: Bauru, São Paulo, Brazil
E-mail: danibuchaim@alumni.usp.br

**Adriane Gonçalves Moura Cardozo**
Master of Science in Science and Mathematics Education
Institution: Universidade Cruzeiro do Sul
Address: São Paulo, São Paulo, Brazil
E-mail: adriane.cardozo@cs.ceunsp.edu.br

**Marcel Fernando Inacio Cardozo**
PhD in Medical Sciences
Institution: Centro Universitário Nossa Senhora do Patrocínio (CEUNSP)
Address: Jundiaí, São Paulo, Brazil
E-mail: marcel.cardozo@ceunsp.edu.br

**Marcelo Rodrigues da Cunha**
PhD in Cellular and Structural Biology
Institution: Faculdade de Medicina de Jundiaí (FMJ)
Address: Jundiaí, São Paulo, Brazil
E-mail: marcelocunha@g.fmj.br

## ABSTRACT

Considering that Generation Z has a learning profile distinct from previous generations, preparing students for university poses a pedagogical challenge. This cross-sectional study investigates the learning styles (LS) of students enrolled in preparatory courses for university entrance exams, known as vestibulares in Brazil, aiming to support the development of student-centered pedagogical strategies. A total of 280 students from the General Preparatory Course (GPC) and the Specific Preparatory Course for Medical School Entrance Exams (MPC) were assessed using the Felder and Silverman Learning Style Index (ILS). Gender, age, and exam preparation time were also analyzed. Data were subjected to bivariate analysis and logistic regression (SPSS; $p < 0.05$; 95% CI). The GPC group represented 72.9% of the sample; the average age was 18.9 ± 1.9 years; 56.4% were female; and 75.7% were in their first year of preparation. The most prevalent LS were visual (59.6%), sensorial (58.2%), sequential (45.0%), and active (36.8%). MPC students were more visual, sensorial, and sequential than GPC students, with a statistically significant difference in the sensorial style. No significant differences were found by gender, age, or preparation time. These results highlight the importance of tailoring university teaching strategies to the learning preferences of newer student generations.

**Keywords:** Pre-Medical Education. Teaching Methods. Learning. Active Learning. Experience-Based Learning.

## RESUMO

Considerando que a Geração Z possui um perfil de aprendizagem distinto das gerações anteriores, preparar os estudantes para a universidade representa um desafio pedagógico. Este estudo transversal investiga os estilos de aprendizagem (EA) de alunos matriculados em cursos preparatórios para os exames de admissão universitária, conhecidos como vestibulares no Brasil, com o objetivo de apoiar o desenvolvimento de estratégias pedagógicas centradas no aluno. Um total de 280 estudantes dos cursos Preparatório Geral (GPC) e do Curso Preparatório Específico para o Vestibular de Medicina (MPC), foram avaliados utilizando o Índice de Estilos de Aprendizagem de Felder e Silverman (ILS). Também foram analisadas as variáveis de gênero, idade e tempo de preparação para os exames. Os dados foram submetidos à análise bivariada e regressão logística (SPSS; $p < 0.05$; IC 95%). O grupo GPC representou 72,9% da amostra; a idade média foi de 18,9 ± 1,9 anos; 56,4% eram do sexo feminino; e 75,7% estavam no primeiro ano de preparação. Os estilos de aprendizagem mais prevalentes foram visual (59,6%), sensorial (58,2%), sequencial (45,0%) e ativo (36,8%). Os estudantes do MPC foram mais visuais, sensoriais e sequenciais do que os do GPC, com diferença estatisticamente significativa no estilo sensorial. Não foram encontradas diferenças significativas em relação ao gênero, idade ou tempo de preparação. Esses resultados destacam a importância de adaptar as estratégias de ensino universitário às preferências de aprendizagem das novas gerações de estudantes.

**Palavras-chave:** Educação Pré-Médica. Métodos de Ensino. Aprendizagem. Aprendizagem Ativa. Aprendizagem Baseada em Experiências.

## RESUMEN

Considerando que la Generación Z tiene un perfil de aprendizaje distinto al de generaciones anteriores, preparar a los estudiantes para la universidad representa un desafío pedagógico. Este estudio transversal investiga los estilos de aprendizaje (EA) de estudiantes matriculados en cursos preparatorios para los exámenes de ingreso a la universidad, conocidos como vestibulares en Brasil, con el objetivo de apoyar el desarrollo de estrategias pedagógicas centradas en el estudiante. Un total de 280 estudiantes del Curso Preparatorio General (GPC) y del Curso Preparatorio Específico para el Examen de Ingreso a la Facultad de Medicina (MPC) fue evaluado mediante el Índice de Estilos de Aprendizaje de Felder y Silverman (ILS). También se analizaron el género, la edad y el tiempo de preparación para el examen. Los datos fueron sometidos a análisis bivariado y regresión logística (SPSS; $p < 0,05$; IC del 95%). El grupo GPC representó el 72,9% de la muestra; la edad media fue de 18,9 ± 1,9 años; el 56,4% eran mujeres; y el 75,7% se encontraba en su primer año de preparación. Los estilos de aprendizaje más prevalentes fueron visual (59,6%), sensorial (58,2%), secuencial (45,0%) y activo (36,8%). Los estudiantes del MPC fueron más visuales, sensoriales y secuenciales que los del GPC, con una diferencia estadísticamente significativa en el estilo sensorial. No se encontraron diferencias significativas en función del género, la edad o el tiempo de preparación. Estos resultados destacan la importancia de adaptar las estrategias

de enseñanza universitaria a las preferencias de aprendizaje de las nuevas generaciones de estudiantes.

**Palabras clave:** Educación Pre-Médica. Métodos de Enseñanza. Aprendizaje. Aprendizaje Activo. Aprendizaje Basado en la Experiencia.

## 1 INTRODUCTION

Technological evolution is a transformative agent of social and cultural organization, in which the internet has been a disruptive instrument of the traditional way of interaction, perception, and communication (Caetano; Luedke; Antonello, 2018; Dalmolin *et al*., 2018; Duarte; Nascimento, 2021). The internet has expanded access to education, and the development of adaptive learning systems has consolidated the use of active methodologies and made it possible to meet new educational demands (Fahim *et al*., 2021; Mokahal *et al*., 2021).

The evolution of pedagogical resources imposes a new paradigm, especially for medical education, whose essence is still traditionalist and teacher centered. For the new generation of students, more attractive and enriching resources such as virtual reality and realistic simulation allow the transmission of the preclinical knowledge base necessary for experience-based learning during the final years of training (Caetano; Luedke; Antonello, 2018; Forde; Obrien, 2022).

Generation Z students were born into a fully digital era and spend an average of 15.4 hours per week online. They are multitaskers, highly adaptable to new technologies, and demonstrate complex forms of social interaction and communication compared to previous generations. However, they often show lower levels of focused attention and favor pedagogical approaches grounded in logic and experience, which can complicate the learning process (Kon *et al*., 2017). Their educational path was further affected by the abrupt shift to remote learning during the 2019 coronavirus pandemic, potentially leaving lasting impacts on cognitive development and learning ability (Betthäuser; Bach-Mortensen; Enggzell, 2023).

Learning is a continuous process involving observation, reflection, concept formation, adaptation, and experiential revalidation (Kolb, 2000; Shakeri *et al*., 2022). Environmental, cultural, and cognitive factors, along with motivation, influence individual preferences in acquiring, processing, organizing, storing, and retrieving information. These preferences are known as learning styles (LS) (Duarte; Nascimento, 2021; Fahim *et al*., 2021; Kolb, 2000). Environments that respect individual learning behaviors can enhance student motivation (Czepula *et al*., 2016).

LS derive from constructivist and individualized learning theories and support the creation of multimodal, student-centered approaches. Teaching strategies aligned with perceptual and processing preferences can improve academic performance, stimulate cognitive development, and reduce demotivation and learning disruptions (Dantas; Cunha, 2020; İlçin *et al*., 2018). While LS are often stable and innate, alternative styles can be developed with exposure to new experiences (Kappe *et al*., 2009). Educators thus play a central role in mediating the learning process, promoting autonomy and helping students acquire essential skills in a dynamic world (Cognuck *et al*., 2023).

Several validated tools assess LS, including VARK (Visual, Aural, Read/Write, Kinesthetic), Kolb's Learning Style Inventory (LSI), Dunn Learning Styles, and the Index of Learning Styles (ILS) (Aguiar; Fechine; Costa, 2015). The ILS, based on cognitive and behavioral theories (Cabual, 2021; Hu *et al*., 2021), has been widely applied in medical education to assess how individuals absorb and process information. It categorizes learners into eight types across four domains and measures the strength of their preferences (Dalmolin *et al*., 2018). Table 1 presents a diagram illustrating the possible interpretations of each learning domain and style:

Table 1. Description of learning styles according to their respective domains.

| Domain | Styles | Descriptive profile |
|---|---|---|
| Perception | Sensorial | They are practical and adaptable, thinking concretely through procedures and avoiding the abstract. They learn via facts, experiences, and standardized memorization methods. |
| | Intuitive | Innovative and creative, they focus on abstract thinking and avoid repetition. They learn by discovering new possibilities from patterns, concepts, theories, and relationships, attributing meaning to discoveries. |
| Input | Visual | They have strong observation and memorization skills through images, preferring explanations with audiovisual aids, demonstrations, graphs, diagrams, flowcharts, and other visuals. |
| | Verbal | Auditory learners easily recall what they hear, preferring spoken and written explanations and active participation in discussions. |
| Processing | Active | Some have a participatory style, favoring group work, data interaction, challenges, learning by doing, and an experimentalist approach. |
| | Reflective | They tend to be theoretical, reflecting on problems before acting and working better alone. |
| Understanding | Sequential | Linear processors understand best when information is presented in stages with increasing complexity. |
| | Global | Non-linear thinkers solve complex problems by grasping the whole context first, then breaking it into parts. |

Source: Extracted from the literature ( Duarte; Nascimento, 2021; Cardozo *et al*., 2024; Felder; Spurlin, 2005; Heenaye; Gobin; Khan, 2012; Jesus, 2022; Hamada; Nishikawa; Brine, 2013) and adapted by the author himself.

Given these characteristics, the ILS appears particularly suitable for evaluating the learning preferences of today's students entering higher education, especially in medicine, which demands critical and analytical thinking (Amaral; Silveira, 2015). The development of such thinking in secondary education differs considerably from its application in medical school, creating potential mismatches between early university instruction and previous learning experiences (Childs-Kean; Edwards; Smith, 2020; Fahim *et al*., 2021).

Higher education challenges students by requiring more autonomy, motivation, and self-directed learning. As a result, preparatory courses are common and aim to develop analytical thinking while helping students make informed career choices (Brown, 2023). In some countries, selection processes include interviews and aptitude tests, though these can disadvantage candidates with fewer resources (Haug; Fisher; Hagel, 2023).

In Brazil, university admission is based on standardized tests called vestibulares. These assessments, consisting of multiple-choice questions and essays based on high school content, promote fairness by avoiding subjective

criteria. Due to the competitiveness of these exams, preparatory courses have become increasingly popular. However, this preparatory phase is often marked by anxiety, pressure, and fear of failure. Choosing a career path at an early stage also demands strong motivation (Graf *et al*., 2007; Hernández-Torrano; Ali; Chan, 2017).

Motivation is a key predictor of success in medical school admission (Haug; Fisher; Hagel, 2023). Although LS influence motivation in university students, research on adolescents remains limited (Amaral; Silveira, 2015). Given the shifting social context and educational challenges, understanding pre-university learning is essential (Brdesee; Alsaggaf, 2021; Cardozo *et al*., 2024; Li *et al*., 2023). Such insight can reveal learning barriers and guide curriculum adjustments to meet evolving needs (Senkevics; Carvalho, 2023; Weppert *et al*., 2023). Despite the relevance of this issue, few—if any—studies have assessed LS among students enrolled in university entrance exam preparatory courses.

Therefore, the present study aims to identify and compare the learning styles of high school students enrolled in a generalist preparatory course (GPC) with those in a medical-specific preparatory course (MPC). Additionally, it seeks to determine whether students demonstrate unimodal or multimodal learning patterns and to analyze group differences based on gender, age, and preparation time for university entrance exams.

## 2 METHODOLOGY

### 2.1 STUDY DESIGN

A cross-sectional, analytical and quantitative study was carried out on the learning styles of students in preparatory courses for university entrance exams. The study was approved by the Research Ethics Committee and registered with the National Health Council, Ministry of Health. The study obtained consent from all participants and/or their parents or legal guardians.

## 2.2 SAMPLE

The study was conducted with 394 students enrolled in two preparatory courses offered by an educational institution in São Paulo state, Brazil: (I) a General Preparatory Course (GPC), featuring a broad curriculum across exact, human, and social sciences; and (II) a Medical Preparatory Course (MPC), designed for students with a focus on biological sciences and preparation for medical school admission.

## 2.3 ASSESSMENT OF LEARNING STYLES

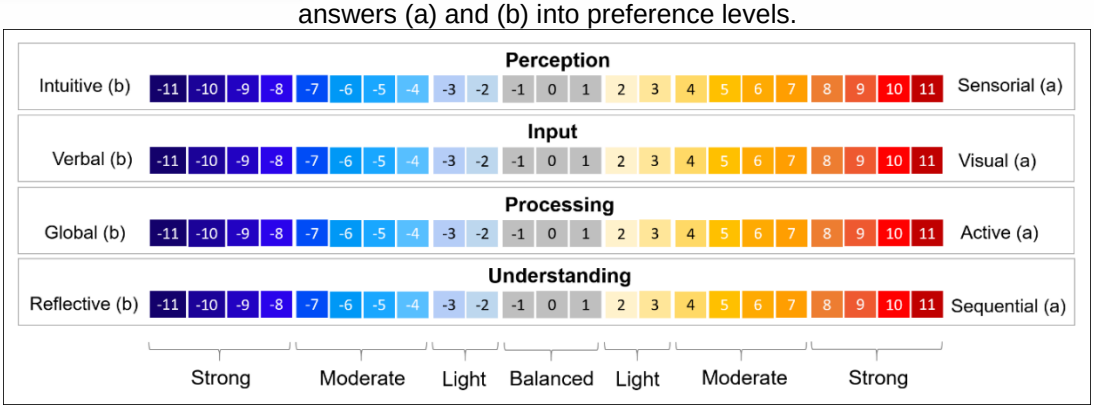
The Index of Learning Styles (ILS), developed by Felder and Silverman (1988) and validated by Felder and Spurlin (2005), is a 44-question questionnaire that assesses preferences in receiving and processing information across four domains: (1) Perception – how individuals react to information, sensory or intuitive; (2) Input – preference for receiving information, visual or verbal; (3) Processing – how individuals transform information into knowledge, active or reflective; (4) Understanding – mental organization of concepts, sequential or global.

Each domain contains 11 dichotomous questions with answers falling between two poles (a) or (b), representing learning styles. Scores range from 1 to 11 points, calculated by subtracting points for each pole. For example, if a Perception question scores 9a and 5b, the difference is 4a, indicating a sensory preference; conversely, a 3a and 9b difference of 6b indicates an intuitive style. The ILS classifies tendencies as follows (Heenaye; Gobin; Khan, 2012):

I. (-3 to 3) Balanced – no strong preference, even if biased toward one pole;
II. (-7 to -5 or 5 to 7) Moderate tendency toward a learning style;
III. (-11 to -9 or 9 to 11) Strong preference for a specific style.

This study employed a modified classification: (-1 to 1) Balanced; (±2 to ±3) Light; (±4 to ±7) Moderate; (±8 to ±11) Strong (Figure 1). Data were tabulated and processed using the EdA learning platform developed by Jesus (2022), designed specifically to analyze learning preferences per ILS (Figure 1).

Figure 1. Distribution of learning styles by domains, classified by the differences between answers (a) and (b) into preference levels.




Source: Prepared by the authors themselves.

Participants were provided with a link that granted access to the EdA platform. After confirming consent to participate, the platform directed them to a second virtual screen intended for collecting the following data: preparatory course (GPC or MPC), gender (male/female), age (≤18 years / ≥18 years) and how long the student has been preparing for university exams (1 year / 2 to 4 years). Participants were then directed to the online ILS to answer the 44-question questionnaire. The percentage of students who present unimodal and multimodal learning preferences according to the preparatory course were also evaluated.

## 2.4 STATISTICAL ANALYSIS

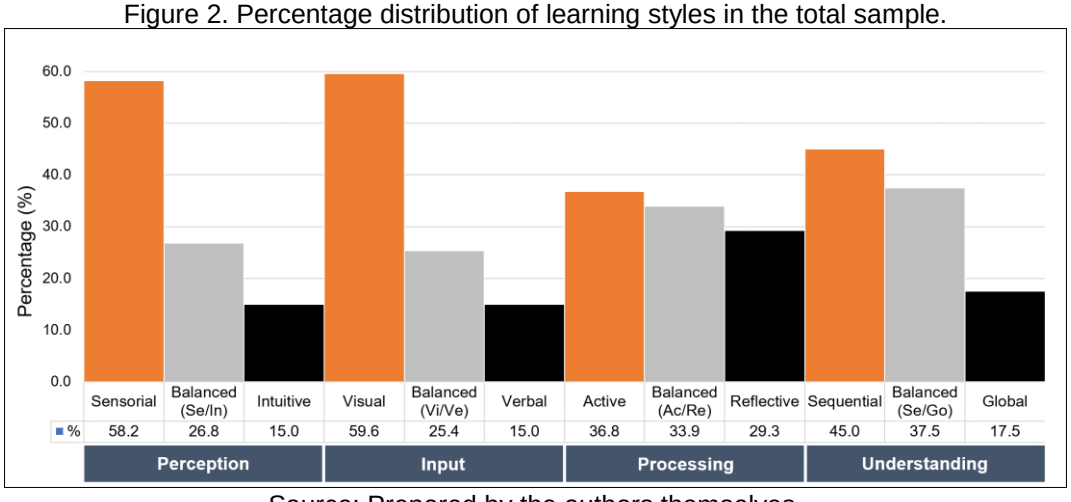
The independent variables (course, sex, age, and exam preparation time) and dependent variables (four domains), classified into preference levels (balanced, light, moderate, strong), were first analyzed descriptively. Bivariate analysis followed, assessing each domain by independent variable using Yates' chi-square test (with continuity correction) for 2×2 tables, Fisher's exact test when Yates was inapplicable, or Pearson's chi-square test for larger tables. Multiple logistic regression was then used to confirm findings. A significance level of $p < 0.05$ and a 95% confidence interval were adopted. Analyses were conducted using SPSS v.24 (Cardozo *et al*., 2024).

## 3 RESULTS AND DISCUSSION

The ILS was administered virtually to 394 students, of whom 280 consented to participate and completed the questionnaire. The students had a mean age of 18.9 ± 1.9 years, and the majority were female, accounting for 62.9% of the sample (n = 176). In the total sample (n = 280), the sensing learning style was predominant in the Perception domain (n = 163; 58.2%). Regarding the Input domain, most participants demonstrated a visual preference (n = 167; 59.6%). The active style was most frequent in the Processing domain (n = 103; 36.8%), and the sequential style was most common in the Understanding domain (n = 126; 45.0%).

This learning profile—characterized by sensing, visual, active, and sequential styles—was also reported in another Brazilian study assessing 556 high school students. The authors attribute the preference for visual and experiential learning to advancement of technological resources and mobile devices, which have reinforced the visual mode of information reception (Pereira; Vieira Jr, 2013). Figure 2 presents the percentage distribution of learning styles across each ILS domain identified in the present study:

Figure 2. Percentage distribution of learning styles in the total sample.

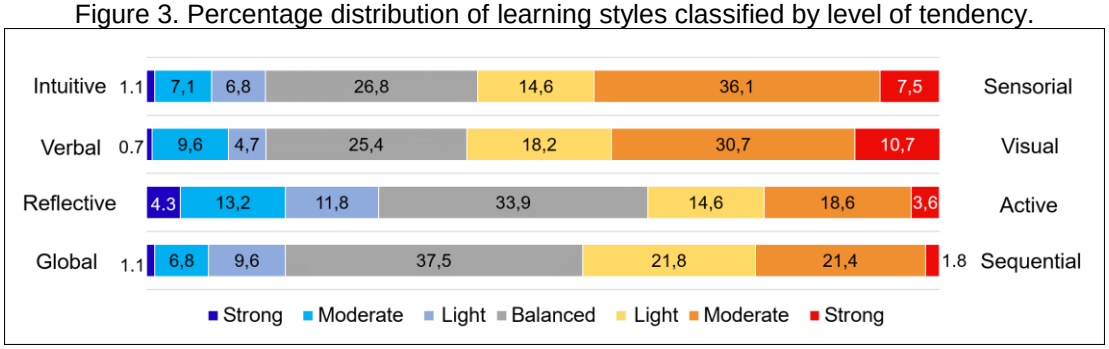



Source: Prepared by the authors themselves.

The Processing and Understanding domains showed a more balanced distribution, without a strong tendency toward a specific learning style. Approximately 37.5% of the sample reported a preference for both the sequential

and global styles in the understanding domain. Regarding the processing of information, 33.9% of participants exhibited a balanced preference between the active and reflective styles. In contrast, in the Perception and Input domains, a moderate to strong tendency toward the sensing and visual styles was observed, as shown in Figure 3:

Figure 3. Percentage distribution of learning styles classified by level of tendency.



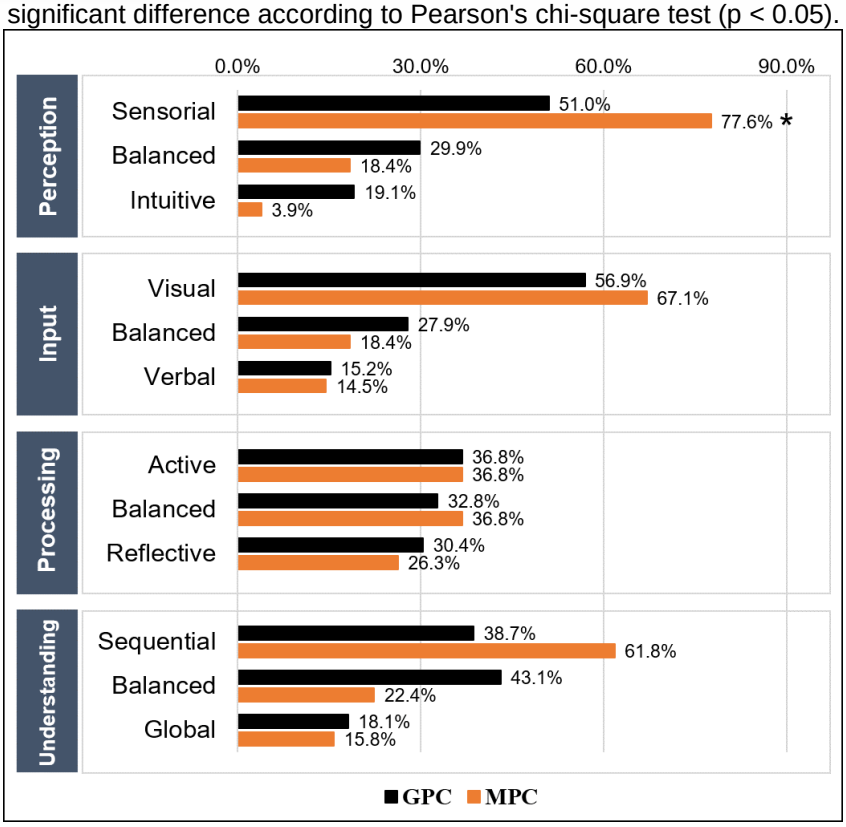

Source: Prepared by the authors themselves.

Students in the MPC group predominantly exhibited the sensing style in the Perception domain, visual in Input, and sequential in Understanding. In the Processing domain, MPC participants showed a preference for either the active or a balanced style, both with the same percentage (36.8%).

Students in the GPC group preferred the sensing, visual, and active styles; however, in the Understanding domain, they were balanced between the sequential and global styles (43.1%).

A significant difference was observed in the sensing style for the MPC group compared to the GPC group ($p < 0.001$). The visual style was the second most frequent, but this difference was not statistically significant ($p = 0.226$). Processing styles were balanced between active and reflective, regardless of the course ($p = 0.750$). In the Understanding domain, MPC students tended to prefer the sequential style more than GPC students, although the difference was not statistically significant ($p = 0.638$). Figure 4 presents the percentage distribution of learning styles (LS) according to ILS domains and preparatory course type:

Figure 4. Percentage distribution of learning styles by domain and preparatory course; (*) significant difference according to Pearson's chi-square test ($p < 0.05$).




Source: Prepared by the authors themselves.

Multiple logistic regression analysis confirmed the statistically significant difference for sensory style between GPC and MPC courses (Table 2).

Table 2. Multiple logistic regression analysis.

| Variable | B | S.E. | Wald | Df | Sig. | Exp(B) |
|---|---|---|---|---|---|---|
| Student_Course | 0.942 | 0.276 | 11.605 | 1 | 0.001 | 2.564 |
| Constant | -0.459 | 0.144 | 10.192 | 1 | 0.001 | 0.632 |

Source: Prepared by the authors themselves.

These findings are consistent with other studies in the literature that analyzed the LS of first-year medical students, who theoretically share similar learning profiles with students in the medical preparatory course analyzed in the present study. A cross-sectional analysis revealed a predominance of the visual (80.8%) and sequential (60.5%) learning styles (Hernández-Torrano; Ali; Chan, 2017), while Liu and Liu (2023) identified a visual preference in 73.9% of a sample of 411 students. Additionally, Saleem *et al*. (2024) found a 57.2% visual preference among 297 students.

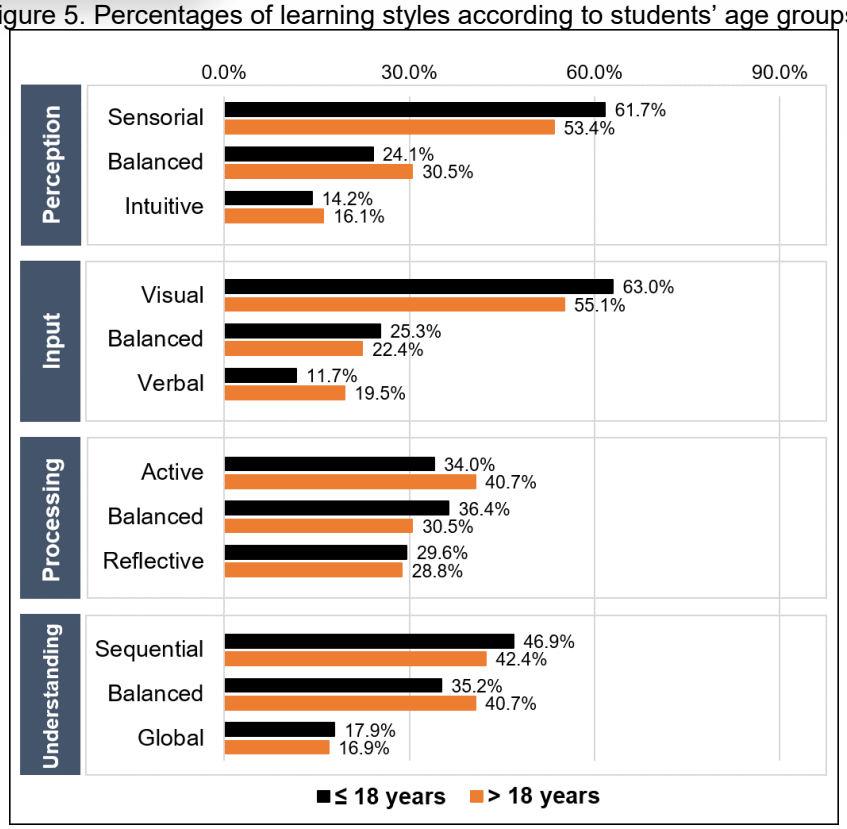
In Brazil, Cardozo *et al*. (2024) assessed 335 medical students from the first to the sixth year and identified the same learning style preferences observed in the present study (sensing, visual, sequential, and balanced active-reflective). However, unlike the current study, they did not find significant differences across academic years, whereas our results showed a significant difference in sensing style preference. A similar profile has also been reported in other health-related fields. Cognuck *et al*. (2023), for example, assessed first-year university students using the ILS and identified the sensing, visual, and sequential styles. However, they reported a preference for reflective processing, which differs from the findings of the present study.

For the analysis of LS in relation to age, two age categories were adopted: students aged ≤ 18 years and students aged > 18 years.

Approximately 56.4% of the sample consisted of adolescent participants (≤ 18 years). Students in the MPC group were, on average, older, with a mean age of 19.5 ± 3.0 years, compared to 18.7 ± 1.7 years in the GPC group. Mean age by gender was similar: females had a mean age of 18.9 ± 1.9 years, and males, 18.8 ± 1.8 years.

Younger students (≤ 18 years) showed a higher predominance of the sensing, visual, and sequential styles compared to older students. A lower preference for the active style was observed among the younger group, a finding that may reflect lower maturity and less initiative in learning through trial and error. In the Processing domain, there was a balance between the active and reflective styles across both age categories. Despite the percentage differences shown in Figure 5, no statistically significant differences were found between age groups in the domains of Perception ($p = 0.361$), Input ($p = 0.178$), Processing ($p = 0.459$), and Understanding ($p = 0.638$).

Figure 5. Percentages of learning styles according to students' age groups.



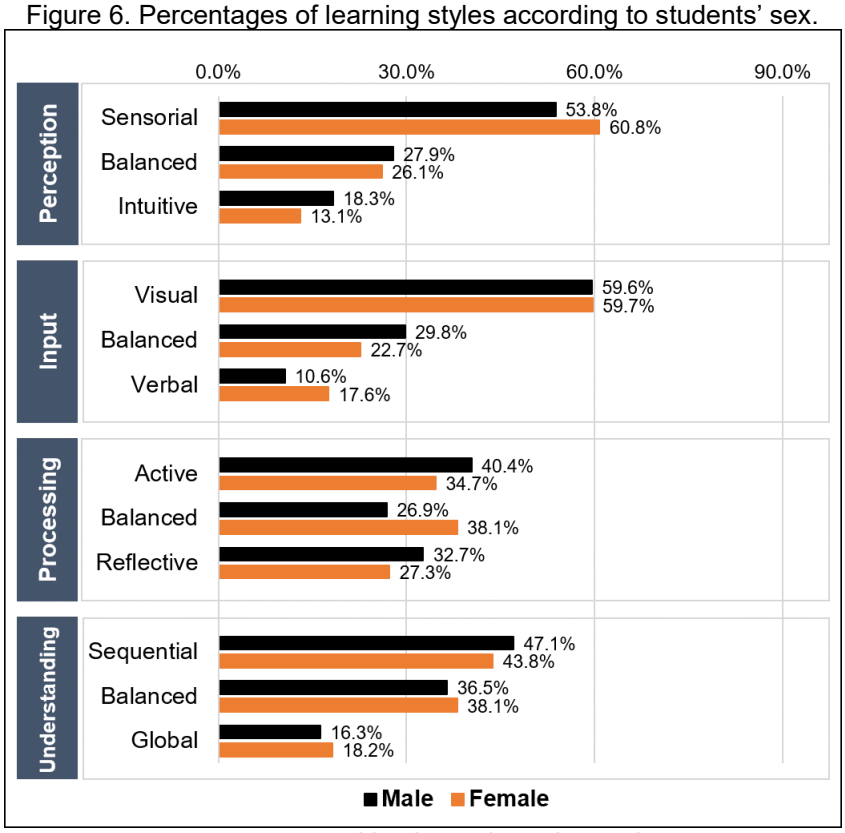

Source: Prepared by the authors themselves.

In the GPC, 57.8% (n = 118) of the students were female. In the MPC, women accounted for 76.3% (n = 58). No significant differences were found between sexes in the domains of perception (p = 0.407), input (p = 0.178), processing (p = 0.163), or understanding (p = 0.847). The absence of significant differences between sexes is consistent with findings from other studies available in the literature (Alghasham, 2012; McCrow; Yevchak; Lewis, 2014). However, other studies have identified gender influences, particularly in the processing domain (active/reflective) (Hernández-Torrano; Ali; Chan, 2017; Liu; Liu, 2023).

In the present study, women showed a tendency to balance their learning between active and reflective styles (38.1%), supporting the hypothesis that women typically learn to solve problems through experimentation (Hosford; Siders, 2010). Although no statistically significant differences were identified, women were more sensing, whereas men were more active and sequential. This characteristic may especially benefit women in the MPC group in disciplines such as anatomy and genetics, which require greater sensory exploration and the

development of standardized reasoning methods (Hernández-Torrano; Ali; Chan, 2017). Figure 6 presents the distribution of learning styles according to the participants' sex:

Figure 6. Percentages of learning styles according to students' sex.

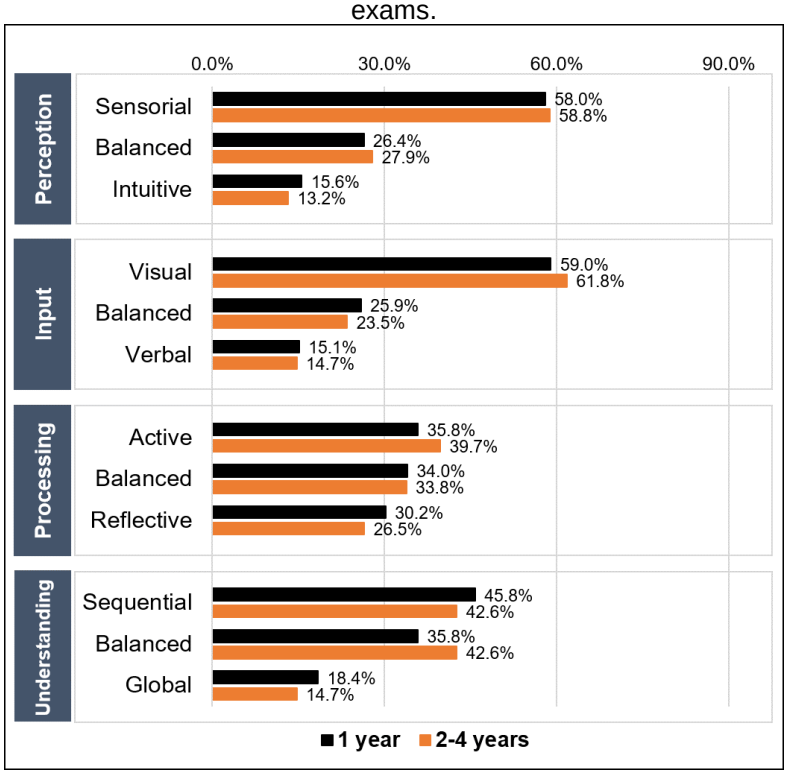



Source: Prepared by the authors themselves.

Regarding academic preparation time, 75.7% of the participants had been preparing for university entrance exams for less than 1 year and 11 months, while the remaining 24.3% had been studying for at least 2 years. In the MPC group, 42.1% of students had been preparing for more than two years, with a mean of 1.7 ± 1.0 years, compared to 17.6% of students in the GPC group, who had a mean preparation time of 1.2 ± 0.46 years. Regardless of preparation time, the sensing and visual learning styles predominated. A balance was observed between active/reflective and sequential/global styles. No significant differences were found with respect to preparation time in the following domains: perception ($p = 0.888$), input ($p = 0.909$), processing ($p = 0.798$), and understanding ($p = 0.564$).

The longer preparation time observed in the MPC group suggests a greater need for study dedication in order to gain admission to public medical schools through university entrance exams. The following figure presents the distribution of learning styles according to preparation time for university entrance exams (Figure 7):

Figure 7. Percentages of learning styles according to preparation time for university entrance exams.




Source: Prepared by the authors themselves.

The sample exhibited a predominantly multimodal learning profile (92.5%), characterized by a moderate to strong tendency to prefer multiple learning styles. Overall, the MPC group showed a higher percentage of multimodal profiles (98.7%) compared to the GPC group (90.2%). All students with a unimodal profile belonged to the GPC group.

Students enrolled in preparatory courses for medical school demonstrated multimodal learning styles similar to those observed in university students. These learners showed a preference for practical demonstrations, multimedia resources, diagrams, flowcharts, and sequential learning with logical progression (Felder; Solomon, 2007; Liu; Liu, 2023; Xing, 2023). Xing (2023) further notes

that individuals with a strong preference for the visual learning style may benefit from the recent pedagogical trend emphasizing audiovisual resources, given that visual stimuli generate a higher cognitive load.

The multimodal preference observed in this study supports findings from American research (Murphy *et al*., 2004) and contrasts with the unimodal patterns frequently identified in the Middle East (Almigbal, 2015; Asiry, 2016; Naggar, 2016; Nuzhat *et al*., 2013). Multimodality promotes holistic learning by stimulating multiple cognitive abilities and enhancing problem-solving skills (Noetel *et al*., 2022). The unimodal style is more commonly found among students with learning difficulties, whereas multimodality has been associated with high academic performance (Fahim *et al*., 2021). Table 3 presents the statistical data on learning profiles according to the preparatory course.

Table 3. Descriptive statistical data of learning profiles according to the preparatory course.

| Learning profile | General (n = 280) n (%) | GPC (n = 204) n (%) | MPC (n = 76) n (%) |
|---|---|---|---|
| None predominant learning style | 2 (0.7) | 1 (0.5) | 1 (1.3) |
| Unimodal | 19 (6.8) | 19 (9.3) | 0 (0.0) |
| Multimodal | 259 (92.5) | 184 (90.2) | 75 (98.7) |
| Bimodal | 82 (29.3) | 65 (31.9) | 17 (22.4) |
| Trimodal | 117 (41.8) | 82 (40.2) | 35 (46.1) |
| Quadrimodal | 60 (21.4) | 37 (18.1) | 23 (30.1) |

Source: Prepared by the authors themselves.

In summary, students enrolled in preparatory courses for university entrance exams exhibited predominantly sensing, visual, active, and sequential learning styles, with the MPC group differing statistically in the sensing dimension. Students aiming for admission to medical school have been in preparation for a longer period and display a multimodal profile, showing a strong preference for specific learning styles.

## 4 CONCLUSIONS

This study demonstrated that students enrolled in preparatory courses generally exhibit learning styles characterized as sensing, visual, active, and sequential. This profile may be associated with traditional teaching methods, which remain teacher-centered and present content predominantly in a visual

format and with increasing levels of complexity. The active processing trait was a noteworthy and positive finding, indicating a preference for group work and experiential learning approaches—an aspect that may support academic performance throughout university studies, where autonomy and participation are often required.

It remains uncertain whether this learning profile stems from students' prior educational backgrounds or if it was developed through active teaching methodologies commonly employed in pre-university preparatory courses. Conversely, the study revealed low scores in certain learning abilities, such as reflective processing, verbal (auditory) input, intuitive learning, and global understanding—highlighting gaps that could be addressed through innovative pedagogical strategies.

The lack of variation in learning styles across age, gender, and length of preparation suggests that these intrinsic factors have little to no influence on learning profiles, underscoring the need to explore extrinsic factors such as cultural, social, economic, and environmental aspects related to education.

The pedagogical orientation of each preparatory course was shown to influence learning styles. Students in the medical preparatory course (MPC) demonstrated a more sensing-oriented perception, greater visual input dominance, and a stronger preference for sequential learning when compared to students in the general preparatory course (GPC), with statistically significant differences observed in the sensing dimension.

The study presented limitations, including the absence of data regarding participants' socioeconomic and cultural backgrounds—factors that may influence cognitive development throughout formal education. Another limitation was the participation of a single training center, which may reflect only a local or microregional context. Nevertheless, the findings contribute to the enhancement of high school pedagogy by indicating the need for adjustments aimed at promoting the development of cognitive skills aligned with the academic and professional demands students will face. Further research is recommended to identify learning styles at regional or national levels and to investigate the influence of other variables on learning preferences and abilities.

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