



## SENSORY MODALITIES AND LEARNING STYLES OF STUDENTS IN THE FIELD OF HEALTHCARE

Tsvetelina Tarpomanova, Silviya Filkova, Minko Milev,  
*Medical College, Medical University, Varna, Bulgaria.*

### ABSTRACT

To make an educational program effective, it is important to identify students' preferred learning styles.

The aim of this pilot study is to investigate the preferred learning styles based on sensory modalities among students in the field of Healthcare and to determine the influence of certain factors (age, gender, specialty, and year of study) on their preferred style.

A total of 78 students from two specialties participated in the study through an anonymous online survey, which included the VARK questionnaire, version 8.01. The study was conducted in December 2024 and January 2025, and the data were processed using SPSS v 22.

Among all respondents, 47.4% preferred a unimodal learning style and 52.6% a multimodal one. The most preferred unimodal style was kinesthetic (59.5%), followed by auditory (35.1%), while the dominant bimodal style was AK (auditory and kinesthetic). No statistically significant relationship was found between learning styles and the examined factors.

Considering the dominant styles (K and AK) among the students, educators should adapt the content of learning materials in a way that facilitates information acquisition.

**Keywords:** learning styles, unimodal and multimodal style, sensory modalities, healthcare students,

### INTRODUCTION

In teaching practice, communication is the primary means of transmitting knowledge. Therefore, the first essential condition for successful interaction with learners is understanding the structure of communication. There are three components of the communication process: interactive, perceptual, and communicative. The perceptual component involves perceiving the other person, the communicative component refers to the transmission of information, and the interactive component entails organizing joint activities and interaction during conversation [1].

The communication between teacher and student has its own specifics, which relate to both the individual characteristics and skills of the teacher and the ways in which students perceive information. The way in which each student primarily acquires, processes, and retains information is described as an individual learning style [2]. A number of popular learning styles have been identified [3, 4]. Studies on learning have shown that many students face difficulties in the educational process due to the way educational material is presented [5]. For some, it is challenging when lectures are delivered only orally, without visual aids; others struggle with written sources, while some cannot comprehend graphically presented ideas unless they are linked to concrete experiences [5].

In neurolinguistic programming, there are three main types of people with characteristic ways of interacting with others: "visual," "auditory," and "kinesthetic"—i.e., we are speaking of three types of sensory modalities. Visual learners perceive most information through their sight, auditory learners through their hearing, and those whose leading channel for perceiving information is through feelings and sensations are called "kinesthetic" learners. These three types form the basis of the different preferences for learning [6, 7, 8].

One of the most commonly used models for studying learning styles is the VARK model, developed by Fleming and Baume, which categorizes learning preferences into four sensory modalities: Visual (V), Auditory (A), Reading/Writing (R), and Kinesthetic (K) [9]. Each

learner has their own preference for a particular approach and a unique style of perceiving information [10].

In recent years, there has been an emphasis on interactive teaching methods such as active learning through case-based problem solving, online learning, collaborative learning through group discussions, and out-of-class self-study using scientific resources [11]. Therefore, to make an educational program effective, it is important to identify students' preferred learning styles.

The aim of this study is to investigate the preferred learning styles based on sensory modalities among students in the field of Healthcare and to determine the influence of certain factors (age, gender, specialty/year of study) on their preferred style.

### MATERIALS AND METHODS

A pilot study was conducted among 78 students in the field of Healthcare, enrolled at the Medical College – Varna, using an anonymous online questionnaire. The first part of the questionnaire explained the purpose of the study and provided an option for informed consent to voluntarily participate in the research. The demographic data collected included: age, gender, specialty, and year of study.

The second part of the questionnaire included the 14 questions of the VARK questionnaire, version 8.01. The VARK tool is used to describe the four learning styles defined by Fleming and Mills—Visual, Auditory, Read/Write, and Kinesthetic [5]. Participants were allowed to choose more than one answer per question. The distribution of preferred learning styles was calculated according to the guidelines provided on the official website ([https://vark-](https://vark-learn.com/)

[learn.com/](https://vark-learn.com/)). Learning preferences were categorized as:

- Unimodal (V, A, R, or K),
- Bimodal (VA, VR, AR, VK, AK, or RK),
- Trimodal (VAR, ARK, VRK, or VAK), or
- Quadmodal (VARK).

The study was conducted in December 2024 and January 2025. Data were analyzed using SPSS v22.

### RESULTS

A total of 78 students from the Healthcare field participated in the study, specializing in Rehabilitation and Dental Technology. Of these, 48.7% (38) were male and 51.3% (40) were female. Age distribution was grouped into three categories:

- 18–24 years – 78.2% (61 students),
- 25–30 years – 10.3% (8 students),
- Over 30 years – 11.5% (9 students).

The surveyed students were from two specialties:

- Rehabilitation – 42.3% (33 students),
- Dental Technology – 57.7% (45 students).

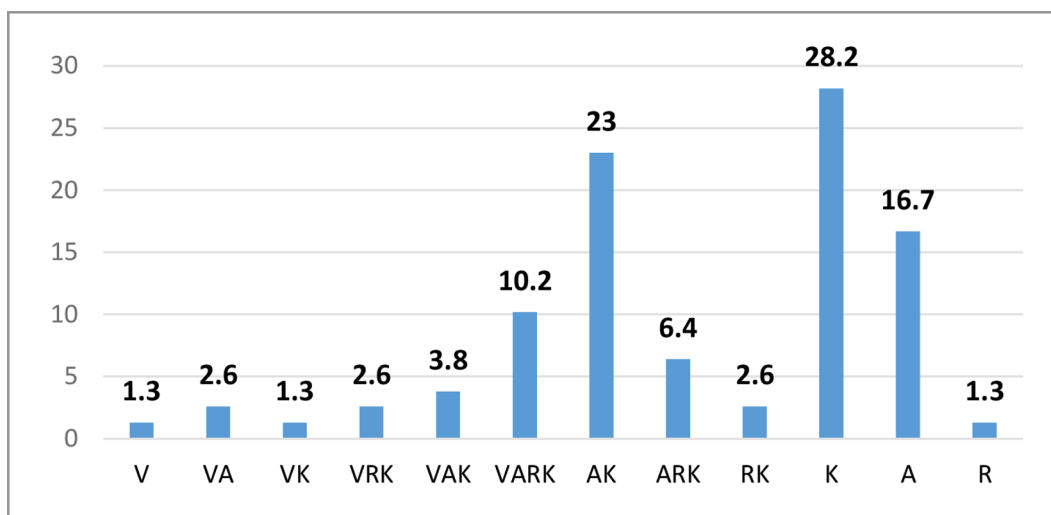
Regarding the year of study:

- 42.3% (33 students) were in their first year,
- 48.7% (38 students) in their second year,
- 9% (7 students) in their third year.

Among all respondents, 47.4% preferred a unimodal learning style (Visual, Auditory, Read/Write, or Kinesthetic), while 52.6% preferred a multimodal learning style (of which 58.5% were bimodal, 22% trimodal, and 19.5% quadmodal).

The most preferred unimodal learning style was Kinesthetic (59.5%), followed by auditory (35.1%), with Visual and Read/Write each accounting for 2.7% (fig. 1).

**Fig. 1.** Distribution of learning styles among the participants in the study



The dominant bimodal learning style was AK (Auditory and Kinesthetic), preferred by 75% of the multimodal learners. Among the trimodal styles, ARK (Auditory, Reading/Writing, Kinesthetic) was the most com-

mon, followed by VAK (Visual, Auditory, Kinesthetic).

No statistically significant differences were found in learning styles between males and females ( $\chi^2 = 14.272$ ,  $df = 11$ ,  $p = 0.22$ ). Similarly, there was no significant associa-

tion between preferred learning styles and age groups ( $\chi^2 = 29.760$ ,  $df = 22$ ,  $p = 0.12$ ), specialty ( $\chi^2 = 6.014$ ,  $df = 11$ ,  $p = 0.87$ ), or year of study ( $\chi^2 = 18.3$ ,  $df = 22$ ,  $p = 0.688$ ).

## DISCUSSION

In this study, multimodal learning styles dominated, identified in 52.6% of the surveyed students. The most prevalent multimodal style was the bimodal auditory-kinesthetic style, preferred by 58.5% of participants. This style was also the most favored bimodal style, chosen by approximately two-thirds of the respondents. The unimodal learning style was preferred by 47.4%, with the kinesthetic style being dominant (48.6%).

Our findings confirm results from previous international studies, which also found that the majority of learners prefer multimodal learning styles [6, 11, 12, 13]. A significant number of students reported unimodal preferences, with the kinesthetic (K) style being the most widespread, similarly to a study on medical and dental students in Pakistan [6]. However, unlike those findings, our students ranked the auditory style second. In another study, the first preferred unimodal style was reading/writing (R), followed by kinesthetic (K) [12]. Research among dental students in Saudi Arabia identified the auditory (A) style as the most preferred, followed by kinesthetic (K) [13], a trend also observed in Iranian students [2]. Another study in Pakistan confirmed kinesthetic (K) as the dominant style among medical students, followed by auditory (A) [18]. Kinesthetic learning preference is also noted in several other studies [15, 16].

An interesting finding in our pilot study among Health Care students is that both the dominant unimodal styles (K and A) and the most preferred bimodal style (AK) belong to the sensory modalities of kinesthetic and auditory information perception. Kinesthetic learning promotes active and creative thinking [17]. Kinesthetic learners rely primarily on personal encounters, sensations, and perceptions; touch and action are crucial. They tend to avoid digital communication, a prevalent information delivery method in modern society. Kinesthetic learners use

specific phrases related to feelings and sensations. This implies that the educational process should stimulate positive sensations to maintain interest and motivation in learning. The fact that many respondents are either auditory or auditory-kinesthetic (AK) learners suggests that the auditory channel should not be neglected when delivering and perceiving information.

Our study found no statistically significant differences in learning styles between male and female students, consistent with other research [18]. Some studies report that males tend to prefer the unimodal kinesthetic style, while females lean towards multimodal styles [6, 13, 19]. Other studies indicate the opposite trend, with males favoring multimodal styles more than females [12, 20]. Such conflicting evidence does not allow for a definitive conclusion.

No statistically significant association was found between learning styles and age groups, specializations, or academic year. Comparisons with other studies suggest that first-year students tend to prefer kinesthetic and visual styles, while second-year students lean towards auditory and visual styles [6].

This study is a pilot with a small sample size, limiting the generalizability of the results. Further, larger-scale and qualitative studies are needed to explore learning style preferences and their relation to teaching methods. Despite these limitations, the information gained can serve as a foundation for adapting teaching to meet the contemporary needs of students in the Health Care field.

## CONCLUSION

The majority of students in the Health Care Curriculum, specializing in Rehabilitation and Dental Technology, prefer multimodal learning styles. Gender, age, and academic year do not significantly influence learning style preferences. Considering the dominant kinesthetic and auditory-kinesthetic styles, educators should adapt their teaching materials to facilitate information processing, thereby enhancing students' motivation and academic performance.

---

## REFERENCES:

1. Thornhill-Miller B, Camarda A, Mercier M, Burkhardt JM, Morisseau T, Bourgeois-Bougrine S, et al. Creativity, Critical Thinking, Communication, and Collaboration: Assessment, Certification, and Promotion of 21st Century Skills for the Future of Work and Education. *J Intell.* 2023 Mar 15; 11(3):54. [PubMed]
2. Akhlaghi N, Mirkazemi H, Jafarzade M, Akhlaghi N. Does learning style preferences influence academic performance among dental students in Isfahan, Iran? *J Educ Eval Health Prof.* 2018 Mar 24;15:8. [PubMed]
3. Hoffmann AF, Fernández-Liporace M. Grasha-Riechmann student learning style scales: an Argentinian version. *J Appl Res High Educ.* 2021; 13(1):242-57. [Crossref]
4. Nge RN, Eamoraphan S. A comparative study of students' perceptual learning style preferences and their academic achievement in learning English as a foreign language at Nelson English Language Centre, Myanmar. *Scholar: Human Sciences.* 2020;12(1):181.
5. Fleming ND, Mills C. Not another inventory, rather a catalyst for reflection. *To Improve Acad.* 1992;11(1): 137-55. [Crossref]

6. Fahim A, Rehman S, Fayyaz F, Javed M, Alam MA, Rana S, et al. Identification of Preferred Learning Style of Medical and Dental Students Using VARK Questionnaire. *Biomed Res Int*. 2021 Oct 18;2021:4355158. [[PubMed](#)]
7. Khadka A, Basnet A, Jaiswal R, Karki S, Shrees Magar S. Learning styles, approaches and academic performance of second and third-year medical students of a medical college of Kathmandu: a descriptive cross-sectional study. *Ann Med Surg (Lond)*. 2024 Jun 26;86(8):4432–8. [[Crossref](#)]
8. Alkhasawneh IM, Mrayyan MT, Docherty C, Alashram S, Yousef HY. Problem-based learning [PBL]: Assessing students' learning preferences using VARK. *Nurse Educ Today*. 2008;28(5):572–9. [[Crossref](#)]
9. Fleming N, Baume D. Learning Styles Again: VARKing up the Right Tree! *Educat Develop*. 2006 Nov; 7.4:4-7. [[Internet](#)]
10. Lujan HL, DiCarlo SE. First year medical students prefer multiple learning styles. *Adv Physiol Educ*. 2006 Mar;30(1):13 6. [[PubMed](#)]
11. Koohestani HR, Baghcheghi N. A comparison of learning styles of undergraduate healthcare professional students at the beginning, middle, and end of the educational course over a 4-year study period [2015-2018]. *J Educ Health Promot*. 2020;9:208. [[Crossref](#)]
12. Ojeh N, Sobers-Grannum N, Gaur U, Udupa A, Majumder MAA. Learning style preferences: a study of pre-clinical medical students in Barbados. *J Adv Med Educ Prof*. 2017; 5(4): 185-94.
13. Aldosari MA, Aljabaa AH, al-Sehaibany FS, Albarakati SF. Learning style preferences of dental students at a single institution in Riyadh, Saudi Arabia, evaluated using the VARK questionnaire. *Adv Med Educ Pract*. 2018;9:179–86. [[Crossref](#)]
14. Mashhood S, Mashhood-uz-Zafar Farooq MF, Fahim MK. Medical student's preferred learning style. *Pak J Surg*. 2018;34(1):36–40.
15. Khanal L, Giri J, Shah S, Koirala S, Rimal J. Influence of learning-style preferences in academic performance in the subject of human anatomy: an institution-based study among preclinical medical students. *Adv Med Educ Pract*. 2019;10:343–55. [[Crossref](#)]
16. Rezigalla AA, Ahmed OY. Learning style preferences among medical students in the College of Medicine, University of Bisha, Saudi Arabia [2018]. *Adv Med Educ Pract*. 2019;10:795–801. [[Crossref](#)]
17. Hudson S. Lessons from the heart: a kinesthetic activity for practical nursing students. *Nurs Educ Perspect*. 2020;41(3):195–6. [[Crossref](#)]
18. Mon AA, Fatini A, Ye CW, Barakat MA, Jen PL, Lin TK. Learning style preferences among pre-clinical medical students. *J Med Allied Sci*. 2014; 4(1):22.
19. Karim MR, Asaduzzaman A, Talukder MHK, Alam KK, Haque F, Khan SJ. Learning style preferences among undergraduate medical students: an experience from different medical colleges of Bangladesh. *Bangladesh J Med Educ*. 2019; 10(2):26–30. [[Crossref](#)]
20. Peteva V, Dushkova M. [Humanization and Digitalization - the Inevitable Challenge in the Education of Economics and Commerce Students.] [in Bulgarian] *Science and Economics: Varna*. 2023; 370-377. [[Internet](#)]

*Please cite this article as:* Tarpomanova T, Filkova S, Milev M. Sensory Modalities and Learning Styles of Students in the Field of Healthcare. *J of IMAB*. 2025 Oct-Dec;31(3):6582-6585. [[Crossref](#) - <https://doi.org/10.5272/jimab.2025314.6582>]

Received: 26/08/2025; Published online: 03/11/2025



**Address for correspondence:**

Assoc. Prof. Silviya Filkova, PhD,  
 Medical College, Medical University, Varna,  
 84 Tzar Osvoboditel Str., 9000 Varna, Bulgaria.  
 E-mail: [silviya.filkova@mu-varna.bg](mailto:silviya.filkova@mu-varna.bg),