

Analysis of learning styles in first semester students at the UACyA UAN: an exploration based on the VARK Model

Análisis de los estilos de aprendizaje en estudiantes de primer semestre en la UACyA UAN: una exploración basada en el modelo VARK.

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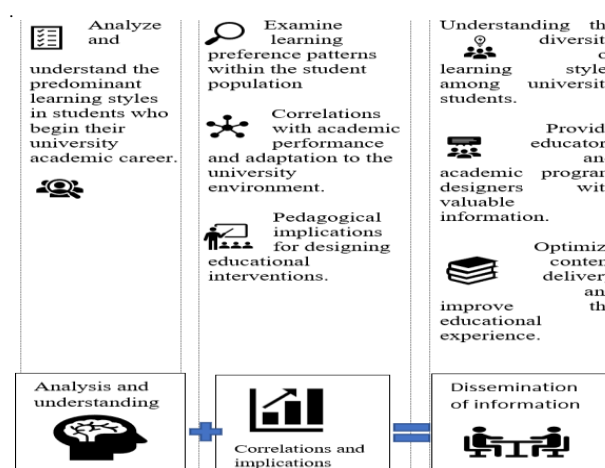


Abstract

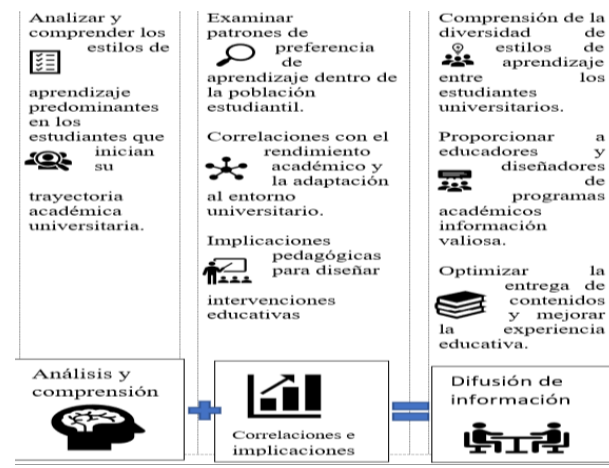
This article analyzes the predominant learning styles in first semester students at the UACyA UAN, which classifies the styles as visual, auditory, reader-writer and kinesthetic. This approach provides a solid foundation for understanding individual learning preferences. The objective is to analyze and understand the predominant styles through a statistical analysis of the results, examining preference patterns and their correlation with academic performance and adaptation to the university environment. Pedagogical implications are explored to design personalized educational interventions that fit the most common learning styles. The results highlight the diversity of learning styles, providing valuable information to improve content delivery and the educational experience. This approach based on the VARK model offers a comprehensive perspective on learning preferences, promoting a more inclusive and effective pedagogy in university education.

Resumen

El presente artículo analiza los estilos de aprendizaje predominantes en estudiantes de primer semestre en la UACyA UAN, el cual clasifica los estilos en visual, auditivo, lector-escritor y kinestésico. Este enfoque proporciona una base sólida para comprender las preferencias individuales de aprendizaje. El objetivo es analizar y comprender los estilos predominantes a través de un análisis estadístico de los resultados, examinando patrones de preferencia y su correlación con el rendimiento académico y la adaptación al entorno universitario. Se exploran implicaciones pedagógicas con el fin de diseñar intervenciones educativas personalizadas que se ajusten a los estilos de aprendizaje más comunes. Los resultados resaltan la diversidad de estilos de aprendizaje, brindando información valiosa para mejorar la entrega de contenidos y la experiencia educativa. Este enfoque basado en el modelo VARK ofrece una perspectiva integral sobre las preferencias de aprendizaje, promoviendo una pedagogía más inclusiva y efectiva en la educación universitaria.



learning styles, VARK model, students



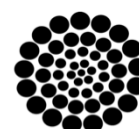
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Introduction

Higher education faces a constant challenge: to ensure that students acquire effective and meaningful learning in their respective disciplines. In this context, it is important to consider the learning styles of higher education students, as this allows the teacher to apply teaching techniques that are appropriate to the needs of the students and therefore to seek better performance within their school career and academic performance.

In this sense, understanding students' learning styles has become a crucial aspect in order to adapt teaching strategies and promote optimal academic performance. The VARK (visual, auditory, reader-writer and kinesthetic) model has emerged as a recognised approach to analysing and understanding individual learning styles.

This research seeks to contribute to the continuous improvement of the educational process at the Academic Unit of Accounting and Administration (UACyA) of the Autonomous University of Nayarit (UAN), by identifying the most common learning styles among first semester students. In addition, it will allow educators to adapt their teaching methods and curriculum design to more effectively address individual learning preferences and needs. In this way, it is expected to promote a more inclusive and efficient learning environment that benefits both teachers and students, thus contributing to academic success and the development of professional competencies.



Figure 1

Análisis de los estilos de aprendizaje

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Theoretical framework

Espinoza-Poves et al. (2019), conducted a study in the business school of a private university in the department of Lambayeque, to know the learning styles of students of Management and International Business Administration; they applied a survey using the VARK model, obtaining as results that in Management students two or more styles predominate (multimodal), while International Business students have a reading/writing learning style. They also found that age is associated with the way of learning. They argue that it is of great relevance to understand the learning styles according to the career that the subjects are following, with the purpose of designing programmes that fit the curricular structure and that employ teaching methods, assessment systems and activities that promote the development of professional competences in students.

Estrada (2018), for his part, carried out an investigation with the aim of identifying the learning styles preferred by students in the third year of the Unified General Baccalaureate, attached to the Alfredo Pérez Guerrero Educational Unit, which belongs to Education District 14D01Morona, and their influence on academic performance; The study argues that these have a significant influence on the academic performance of students and that they cannot be considered as the only determining factor; on the contrary, various elements such as socio-economic factors, teaching methodologies, previous skills and motivation also play an important role. The results showed that the majority of the study population is dominated by a reflective style, characterised by an investigative and analytical approach, as well as their ability to work effectively in a team and to comprehensively understand the analysed data. This, in turn, helps teachers to adapt their pedagogical approaches according to the predominant learning mode.

Style is the set of characteristics that identify the artistic tendency of an epoch, a genre or an author. A person's style consists in the fact that his or her behaviour or performance can be predictable. The combination and intensity of the characteristics of each subject make him or her unique. Although there are subjects who are very similar in certain characteristics, the truth is that the degrees or levels of them are different (Lozano, 2000, p. 18).

Sáez (2018) defines learning as the process of assimilating information that leads to perceptible consequences in behaviour. This procedure involves changes that are evident in a relatively short period of time. From this perspective, it can be stated that learning constitutes the accumulation of information that an individual processes, manifesting itself in changes in behaviour as a result of acquired knowledge, accumulated experience or practice. In essence, learning is a process of construction at both the individual and social level.

In education, it can be achieved effectively by addressing the needs of learners based on defined goals and interaction with the situation, such as family, school and environment. Sáez (2018), argues that autonomous and quality learning is achieved when students have to solve problems and make decisions in a reflective way based on the application of new knowledge.

Gómez and Gil (2018), argue that learning styles refer to the different ways in which each student approaches the understanding of a specific subject. In other words, each individual possesses a unique methodology for assimilating information or tackling a particular task. Therefore, even if the same lesson is given to a group of students, some will be able to grasp it more quickly than others, and some may face difficulties. In extreme cases, those who fail to overcome these difficulties may experience negative consequences, such as course disapproval, a change of career, withdrawal from the subject or even discontinuation of studies (Freiberg et al., 2017).

Therefore, it can be said that learning styles refer to the way in which the learner appropriates content to bring about changes in the way he/she appreciates and modifies the environment in which he/she lives. Knowing how this helps both the student and the facilitator, as it helps the former to establish study techniques and the latter to develop appropriate teaching strategies that allow for efficiency and effectiveness in the performance of their work.

From this perspective, it is crucial for teachers to recognise and understand the different learning styles of students and adapt their teaching strategies effectively based on diversity to meet the needs of all learners more effectively (Kolb and Kolb, 2005; Özyurt and Özyurt, 2015; Papadatou-Pastou et al., 2020, as cited in Alanya et al., 2021). Because teachers act as coaches, it is essential that they recognise the importance of acquiring the right knowledge to carry out effective planning, and they should strive to overcome difficulties and strengthen their pedagogical approaches towards the constructivist perspective. (Muñoz, 2020).

Considering the impact and innovation of technological and social changes, as well as the socialisation and exchange of knowledge, this results in the need for teachers to look for new ways of transmitting knowledge and making higher level students motivated and interested in learning and developing their intellectual skills. Thus, they acquire competences, i.e. skills and abilities according to their needs, which enable them to make decisions and face the circumstances to which they are exposed, but with the ability of prior and professional knowledge (Esteves et al., 2020).

Therefore, learning styles are related to self-awareness, i.e. the individual must be able to identify and know how he/she learns, so that he/she is motivated to achieve his/her learning, leading him/her to reach his/her desired level of development. Personality, abilities, skills, as well as the student's willingness to acquire strategies to face challenges and problems that allow him/her to find a solution to any situation that arises (Esteves et al., 2020).

This allows us to see the importance of students identifying their way of learning, as they must know that this will help them in their comprehensive training, so that the teacher can establish teaching strategies that allow them to evaluate according to the competences of each individual and not in a general way, and therefore the teaching-learning process can be autonomous, independent, continuous and creative. This makes it possible to increase academic performance and reduce student dropout (Villacís et al., 2020).

According to Trelles et al. (2018), learning styles include the way in which one learns and the way in which information is processed, which allows them to interrelate with their environment through their personality and cognition. Therefore, the individual may go through different learning styles throughout his or her life. "To reach a definitive and meaningful appropriation of knowledge" (p.14). De la Paz et al. (2022) mentions that the didactic techniques used in university education are: "lectures, demonstrations, group work and collaborative learning" (p. 85). This allows us to see the role of the teacher in higher education and the transformation that must come from the educational institutions themselves in order to prepare the professionals of the future, who can meet the demands of the modern labour market. Higher education focused on the teaching-learning processes and the individual differences of students, promotes academic processes, active and participatory teaching models, which support students to move from traditional models to more dynamic ones (Isaza, 2014).

It is therefore necessary to know the learning styles, as it is an "enriching process that serves as input for the teaching staff to develop methodological strategies that facilitate the learning of each student, addressing the teaching process individually" (Salas-Cabrera, 2014, p. 167).

There are multiple models that, when applied, make it possible to identify the predominant learning style, and these styles can undergo changes depending on the context. For example, a student may develop a particular style during his or her university education and, upon entering the work environment, may discover new learning modalities. This is why it is essential to teach students to recognise different variations and combinations of styles in order to simplify the educational process (Cardona et al., 2017).

Various authors have created and proposed different learning models over time, as shown in table 1. From which Fleming's study was chosen to be developed in 1987, 1992, in collaboration with Collen Mills, which proposes a classification of people according to the way in which the brain selects the information it perceives through the senses, according to their interests and depending on how the information is received. This proposal gave rise to the instrument applied, which was called VARK after the acronym of the 4 initial letters corresponding to the sensory modal preferences: Visual, Aural, Read/Write and Kinesthetic.

Table 1
Analysis of various authors

Year	Autor	Model	Features
1950s	Herman Witkin	Cognitive styles	It is defined as the way in which human beings perceive, process, encode and retrieve information..
1956	Benjamín Bloom	Bloom's Taxonomy	The conduct of learning requires carefully planned goals, supported by appropriate assessment tools and activities that are aligned with those goals. Bloom's taxonomy, with its hierarchical structure from the simplest to the most complex, highlights the importance of integrating this taxonomy into the formulation of general and specific objectives in research..
1974	David Kolb	The wheel of learning	It is based on experience as the main basis for learning, and on the way information is perceived and processed. It posits that the wheel of learning occurs in a cycle of four phases: <ul style="list-style-type: none"> o Concrete experience, o Reflective observation, o Abstract conceptualisation, and o Active experience He identified four learning styles: <ul style="list-style-type: none"> o Divergent (concrete and reflective). o Assimilative (abstract and reflective) o Convergent (abstract and active) o Accommodating (concrete and active)

Article

1986	Peter Honey y Alan Mumford	Based on the learning wheel	They identify four styles: o Active o Reflective o Theoretical and o Pragmatic
1988	Richard Felder y Linda Silverman	Bipolar dimensions	Model composed of four bipolar dimensions: o Sensory/intuitive, o Visual/verbal, o Active/reflective, and o Sequential/global
1992	Neil Fleming y Colleen Mills	VARK	It is based on sensory modalities, identifying four: o Visual o Auditory o Reading/writing o Kinaesthetic

Source [Own elaboration based on information consulted in Cardona et al., 2017; Peñaloza-Carreón et al., 2022]

In the following, such sensory modalities are described according to the types of people:

Table 2
Types of people according to the VARK sensory representation model

Types of people	Visuals (view)	Auditory (Hearing)	Kinesthetic/kinaesthetic (physical contact)	Readers (Reading and Writing)
Comm only used phrases	Can you see? Can you feel it? Let's see! At first sight... Obviously... It's clear that...	Yes, I heard right..., I'm all ears... Don't play deaf!	I feel that... I feel that..., You have to keep your feet on the ground. Out of common sense..., I smell...	All When talking about any topic, they frequently quote authors or books that deal with it.
Features	They find readings that do not include pictures and colours uninteresting ..	They are very sensitive to the implicit characteristics of sounds, such as loudness, pitch, speed, etc..	They frequently engage in activities related to body expression, such as sports or dance.	Reading is a basic activity for them and while reading they often make notes on the ideas that come to them.
Learning strategies that work best for them	Concept maps, diagrams, synoptic charts, computer animations, videos, photographs and vivid colours.	Receiving verbal instructions, brainstorming, creating songs, cheers and rhymes with the information to be learned, participating in debates and discussions, as well as guided and annotated reading.	Role-play and role-playing, group dynamics that require sitting and standing, moving to the blackboard to solve problems, manipulation of objects to explain phenomena and receiving oral instructions accompanied by objects.	Short writings, literary compositions, blogs, reading reports, summaries, reviews, syntheses and revisions of other students' texts.

Source: Based on (Arredondo, 2019).

From the above it can be summarised that the visual type prefers symbology and images to quickly abstract information, while the auditory type (aural) is dominated by the ability to listen and converse, on the other hand, the reader-writer (read/write) is inclined to read and take notes with the ideas that emerge from it, and the kinaesthetic type (kinesthetic) has a perceptual preference for attending to general questions rather than details, relating experience with practice.

Methodology

The approach of this research is exploratory, with a process of documentary compilation, selecting information that scholars and researchers have made, through bibliographic documents in which the review and selection of literature was carried out through consultations made on websites such as Google academic, Redalyc, scielo and results of research previously conducted in order to obtain information regarding the subject under investigation.

The scope of the study was the first year students of the bachelor's degrees in Administration, Accounting, Marketing and International Business, belonging to the Academic Unit of Accounting and Administration (UACyA) of the Autonomous University of Nayarit (UAN), with a selective sample of 195 students. The VARK questionnaire was used as an evaluation instrument to determine the learning styles (visual, auditory, reading-writing, kinaesthetic) of the participants.

The procedure used for data collection was through a Google form that linked them to a test of learning styles belonging to the PSICOACTIVA website, which has 16 items. At the end of the test, the type and characteristics of the learning style were shown, and the results were sent to the Google form, which allowed them to be classified, analysed and the data interpreted.

Discussion

Learning style is an important factor in human development, which undoubtedly influences the academic environment. In order to identify the learning styles based on the findings of the students in the sample, the General Scale Table developed under the VARK model, see **Figure 2**, was used as the basis for classifying the information. From this, the results were analysed to identify which learning style(s) predominate in them, and to emphasise their most salient aspects in order to identify the changes that should be made in the pedagogical strategies.

Learning style	Description (Fleming and Baume, 2006)	Characteristics (Hawk and Shah, 2007)
Visual	Students with a preference for graphical and symbolic ways of representing information.	It is characterised by a taste for learning by means of maps, charts, graphs, diagrams, flow charts, colours, photographs, figures and different spatial arrangements.
Auditory	Students with a preference for listening to information.	Characterised by a taste for learning by explaining new ideas to others, in discussions with teachers and students, use of stories, etc..
Reading and writing	Students with a preference for graphical and symbolic ways of representing information.	Characterised by a taste for learning from lists, essays, reports, textbooks, definitions, manuals, readings, web pages and notes
kinaesthetic	Students with a perceptual preference related to the use of experience and practice, either real or simulated..	It is characterised by a taste for learning through field trips, trial and error, manipulating artefacts, using laboratories, recipes and problem solving, using their senses and making sample collections.

Figure 2
General Scale Table

Source: own elaboration

Considering the illustration above, the different learning styles present in the educational environment are the individual preferences that determine how learners absorb, process and retain information. Identifying and understanding these styles is essential for creating inclusive and personalised learning environments.

Figure 3 shows the learning style preferences of UACyA students in the first semester of the four academic programmes (Management, Accounting, Marketing and International Business). In which it can be seen that the learning style can be a single one or a combination of them. It is worth mentioning that the percentages are rounded, so a slight difference can be seen in them.

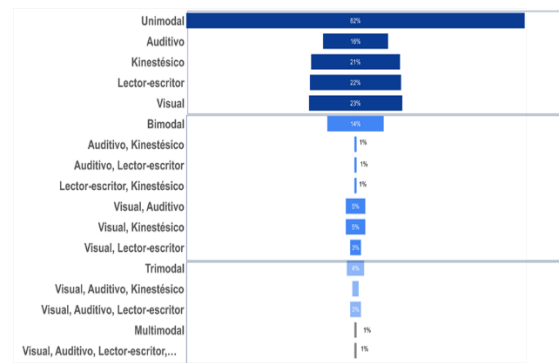


Figure 3
VARK Method Preferences

Source: Own elaboration based on the results of the instrument applied for this research

The previous illustration shows that 82% of the total number of students practice only one style while the remaining 18% share the use of the 4 styles. Mentioning the first percentage being the unimodal style, it is identified that the visual learning style predominates with 23%, the Reading, Writing and Kinaesthetic style is used by 21% respectively and 16% learn in an Auditory way.

The remaining 18% learn with a combination of styles: those who use two learning styles are 14%, those who combine 3 learning styles are 4% and 1% who use all 4 learning styles. It is worth mentioning that each group uses different combinations of learning styles as shown in the illustration.

After identifying that students can present multiple learning styles, it is convenient to review which are the combinations that are presented, which are shown in Figure 3. The total number of combinations of learning styles present in UACyA students in the first semester are 25, of which we can observe unimodal, bimodal, trimodal and multimodal.

Learning style	Number of combinations
Visual	7
Visual, Auditory	
Visual, Auditory, Kinaesthetic	
Visual, Auditory, Reader-Writer	
Visual, Auditory, Reader-writer, Kinesthetic	
Visual, Kinaesthetic	
Visual, Reader-Writer	
Auditory	7
Auditory, Kinesthetic	
Auditory, Reader-Writer	
Visual, Auditory	
Visual, Auditory, Kinesthetic	
Visual, Auditory, Reader-writer	
Visual, Auditory, Reader-writer, Kinesthetic	
Reader-writer	7
Auditory, Reader-writer	
Reader-writer	
Reader-Writer, Kinaesthetic	
Visual, Auditory, Reader-writer, Kinaesthetic	
Visual, Auditory, Reader-writer, Kinaesthetic	
Visual, Reader-writer	
Kinesthetic	5
Auditory, Kinesthetic	
Reader-writer, Kinaesthetic	
Visual, Auditory, Kinesthetic	
Visual, Kinesthetic	
	25

Figure 4
Types of combinations of learning styles
Source: own elaboration based on the results of the instrument applied for this research

Figure 5 shows the predominant learning style in each programme of the Academic Unit, without excluding combinations. This means that this learning style is considered even when it is accompanied by others. In the case of Management, Accounting and International Business, the predominant style is visual, while in Marketing it is Reader/Writer.

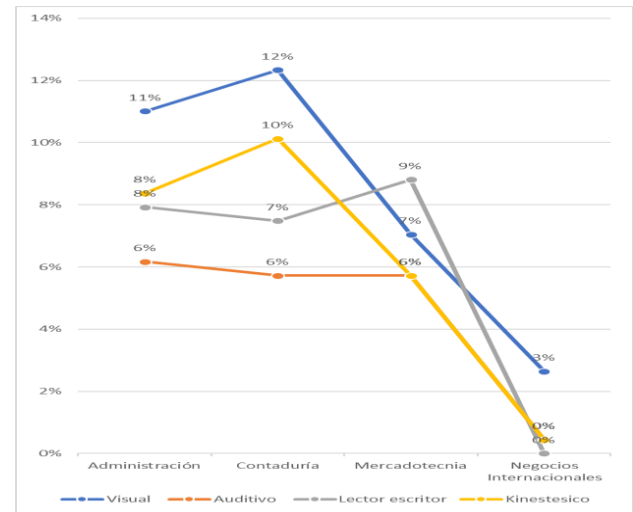


Figure 5
Predominant learning style in each academic programme
Source: own elaboration based on the results of the instrument applied for this research.

With the above, two predominant learning styles are identified: the visual style in the students of Administration, Accounting and International Business. This style is characterised by a preference for processing information through images, graphs and diagrams. They learn best when visual materials such as visual presentations, concept maps and videos are used. Teachers can facilitate this learning style by providing visual resources and encouraging the use of imagination and creativity. In the case of the second predominant learning style is reading-writing, where the reading style is characterised by a preference for processing information through reading, these students learn best when provided with written materials, such as books, articles and lecture notes. Whereas students with a writing learning style benefit from expressing their ideas in writing. Thus, taking notes, writing essays and engaging in creative writing activities are effective approaches. Teachers can promote this style by encouraging critical reading, text-based discussion and summarising, providing opportunities for regular writing and offering constructive feedback.

However, it is important to mention the kinaesthetic learning style, although it is not the predominant one, it is present in all 4 academic programmes. It should be clarified that in Illustration 4 it is presented at 0% since in tenths it is less than 0.5. However, this style is related to the need for movement and tactile experiences in order to understand concepts. Kinaesthetic learners learn best through hands-on activities, role-plays and experiments. Therefore, teachers can incorporate strategies that involve movement and physical manipulation to optimise learning for these students.

With respect to the auditory learning style, which is present in a smaller proportion and without detracting from the presence of this way of learning, it is mentioned that students with this learning style prefer to process information through sound. That is, they listen to verbal explanations, participate in discussions and use recordings. So teachers can encourage auditory learning by providing recordings, group discussions and reading aloud.

Figure 6 shows the resources that teachers can use in a practical way to achieve the objectives set out in their learning unit.

Learning style	Activities
Visual	Diagrams, graphs, colours, charts, written texts
Auditory	Discussions, speeches, audios, seminars, music
Reading and writing	Books, texts, readings, note-taking, essays, bibliographies.
kinaesthetic	Life examples, demonstrations, physical activity, constructions, role play.

Figure 6 Learning tools for each learning style
 Source: Espinoza, Miranda and Chafloque (2019).

Identifying how UACyA students learn is vital for teachers to plan and adapt learning strategies and to promote effective and meaningful educational experiences.

Conclusions

This study on the exploration of the predominant learning styles in first semester students at the Academic Unit of Accounting and Administration (UACyA) of the Autonomous University of Nayarit (UAN) according to the VARK model has yielded significant results and valuable conclusions to improve the educational process. The main conclusions derived from the research are presented below:

A significant diversity of learning styles is evident among first semester students, highlighting specific sensory preferences. The VARK (Visual, Auditory, Reading/Writing and Kinaesthetic) classification identified individual patterns and provided a detailed understanding of how students approach information.

Many students were found to have multimodal preferences, i.e. they showed an affinity for more than one learning style. This finding underlines the importance of recognising complexity and individuality in learning preferences, suggesting the need for flexible and adaptive pedagogical approaches.

The research highlights the need for educators to be aware of the diversity of learning styles in the classroom. Teacher adaptability, based on an understanding of individual student preferences, is presented as a key factor in optimising teaching and academic performance. Thus, the variety of learning styles underlines the importance of designing personalised instructional strategies. Teachers can benefit from incorporating methods and resources that address visual, auditory, reading/writing and kinaesthetic preferences, thereby promoting more effective learning.

The VARK model proved to be a valuable tool for identifying and understanding learning styles. Its applicability in educational settings facilitates the adaptation of pedagogical practices and contributes to a more learner-centred approach. Whereas the research advocates the development of inclusive strategies that consider the diversity of learning styles. These strategies could foster an educational environment that caters for needs, thus promoting more holistic and successful learning.

For, the exploration of learning styles is a dynamic and evolving field. It suggests the continuation of similar research to assess changes in preferences throughout the academic trajectory and to constantly adapt pedagogical strategies.

In summary, this overview study provides a detailed description of the predominant learning styles of first semester students at UACyA UAN, highlighting the importance of adapting teaching strategies to optimise academic performance and foster an inclusive educational environment.

Declarations

Conflict of interest

The authors declare that they have no conflicts of interest. They have no financial interests or personal relationships that may have influenced the article reported in this paper.

Authors' contribution

Rocio Mabeline Valle Escobedo and Laura Esther García Gómez carried out Theoretical framework and research methodology.

Raquel Castañeda Ibarra and Juan Marcos Rivera Barajas performed the analysis of the data from the Google form used, as well as the tables.

All authors contribute to the preparation of the summary, Results and contributions of the document.

Availability of data and materials

The data obtained in this research are available for consultation and analysis.

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Abbreviations

1. UACyA Unidad Académica de Contaduría y Administración
2. UAN Universidad Autónoma de Nayarit
3. VARK (visual, auditivo, lector-escritor y kinestésico)

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Background

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Discussions

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