

# University learning style model: Bibliometrics and systematic literature review

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## ABSTRACT

The university learning style worldwide was analyzed to obtain a model adapted to Peru, that was complemented in the initial part with the study of the bibliometric analysis. In the first steps that were developed, the information search was done in a general way with Scopus. Then specifically adding the Dimensions database, obtaining 59 items from the selection. The Prism statement was used, which allowed it to be developed in the methodology sequentially until the selected articles were obtained. The objective was to carry out a study of the systematic review of the literature (RSL) that allowed analysis by categories such as academic performance, teaching strategy and competencies related to the learning style. Where the data obtained was with the use of VOSviewer and Rstudio. The result obtained was an innovative model that relates the categories with the most relevant models that studied the learning style. As a conclusion, the different learning styles can be adapted to the different study programs and their different courses to plan it from the macrocurricular to the microcurricular, taking into account the strategy and the didactics of teaching, the contribution for the university sector.

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## 1. INTRODUCTION

Regarding learning in the context of the COVID-19 pandemic, the Economic Commission for Latin America (ECLAC) in 2020 indicates that the pandemic has impacted the world in all sectors; one of them was the education sector where more than 190 countries initially closed in order to reduce contagion and thus avoid the exponential growth of the virus. Leading to the deployment of distance learning modalities, through the use of a variety of platforms, which despite the efforts of teachers to teach and students to learn, pre-pandemic levels have not been achieved; especially in academic activities where presence is preponderant [1], [2]. Every country in the world has been affected by the COVID-19 pandemic. In the educational sector, universities migrated their classes to the virtual modality. The method and strategies of teaching-learning in the virtual modality are different from the face-to-face one. In this sense, learning in the virtual modality of university students is different, since each student has a different learning style. In Peru, the Ministry of Education modified article 47 of University Law 30,220; giving universities the option to offer classes to their students in virtual mode. Most of the Peruvian Universities carried out training for their teachers and also for their students.

Learning styles vary from one student to another and allow university students to acquire skills according to their nature and the strategies that the teacher applies in their classes [3], [4]. It is worth mentioning that there are demographic aspects such as: age, gender, type of school of origin, and place of residence; also the human part among others, that could influence the construction of learning. Likewise, the learning style could be related to the methodology, the didactic strategy and the teaching-learning techniques. The academic performance of the students will depend on many variables [3], [5]; one of them is the academic part and this is related to the teaching strategy and didactics by the teacher. The learning style of the students is different in each one of them, that is why it is important that teachers are trained in topics related to learning styles and their strategy to be carried out in a concrete way.

The objective is to carry out a systematic review of the literature (RSL) on the learning style in university higher education, to investigate its characteristics, attributes and all the variables that are necessary to deepen the object of study. Thus, to be able to concretize and make appropriate decisions in the university education sector. The categories of academic performance, teaching strategy and skills were taken into account; thus in this way propose an innovative model of the relationship of learning styles with the categories mentioned.

## 2. RESEARCH METHOD

The research work is focused on carrying out the RSL regarding the learning style of university higher education students. It has a quantitative approach, since it is complemented by a bibliometric analysis. The scope of the research is descriptive, not experimental. Figure 1 explain the stages that were carried out in the investigation. Figure 1(a) shows the steps of carrying out all the activities in a generic way, from the beginning to the end. Instead, in Figure 1(b), the search for information is specifically emphasized.

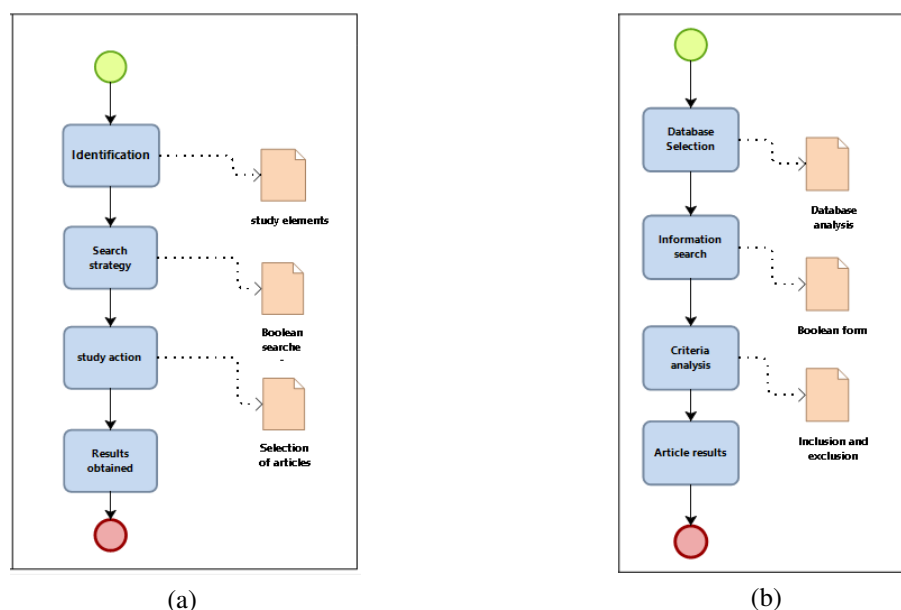


Figure 1. Literature review process for (a) generic process and (b) specific process

### 2.1. Holistic analysis

In this stage, the search for information was analyzed generically and specifically through an appropriate strategy. This strategy was carried out using Boolean operators such as and and or mainly. In addition, different databases were used to obtain the information after the selection. After analyzing databases such as Scopus, Dimensions, Google Scholar, Scopus and Dimensions were chosen. Where Scopus is one of the largest in the world, as well as Dimensions is a free access database. Discarding Google Scholar as it contains some unreliable and unreliable sources. This was the reason for using these two databases that contain enough information on its magnitude and relevance.

## 2.2. Research questions

After being an exhaustive analysis, 3 questions were asked that respond to the objective of the investigation. For this, it was related to academic performance, teaching strategy and the skills acquired by students. Table 1 shows the questions asked, encoding each question with the letter Q.

Table 1. Research questions

Code	Questions
Q1	How is academic performance related to learning styles?
Q2	How are teaching strategies related to learning styles?
Q3	How are competencies acquired by students according to learning styles?

## 2.3. Search strategy

### 2.3.1. Generic search strategy

First, a generic search was made to carry out the bibliometric analysis. In this way, it allows to have a broad overview of how the main variable is found, which is the learning style at the international and national levels. Then, the search was carried out by countries that investigate the most, the most frequent keywords they use, thematic trends by author, co-occurrence, among others. In addition, the search was carried out with Scopus since it is one of the first that contains a large amount of metadata. Words such as "learning style" "higher education" and "university" were used, obtaining 3,215 paper. To do this, these papers were exported to the VOSviewer software and to the R programming language with its integrated development environment (IDE) R Studio; allowing for in-depth analysis.

### 2.3.2. Specific search strategy

After formulating the questions, proceed to apply an information search strategy on the subject, that is, the specific search. The search was performed using Boolean equations such as and, or. Different databases were searched such as Scopus (154 paper) by title, Dimensions (2,741 paper) by title and abstract. The following was used Boolean equation (("learning style") AND ("higher education" OR "university")).

## 2.4. Inclusion and exclusion criteria

Table 2 shows the criteria that were taken into account, such as articles from recent years, due to the trend and the context for updating. In addition, languages, non-free access articles such as exclusion (EC), among others. This allows the scope of the investigation to be clear and precise.

Table 2. Eligibility criteria

Criterion	Code	Description
Inclusion	IC1	Articles related to learning style.
	IC2	Articles published between 2018 and 2022.
	IC3	Articles in the English language.
	IC4	Open access articles.
Exclusion	EC1	Articles outside the scope of the investigation.
	EC2	Articles outside the scope of the investigation.
	EC3	Articles that do not contain Spanish language.
	EC4	Articles that do not answer the selected questions.

## 3. RESULTS

### 3.1. About the search for information

In Figure 2, the selection of articles is shown using Scopus and Dimensions metadata, obtaining a total of 2,895 articles. In this way, a deep analysis could be carried out, to obtain the most appropriate articles that allow achieving the objective of the investigation. The number of articles was made by exporting in .bib; then it was passed to the Mendeley for analysis.

### 3.2. About the selection of the articles

The steps to be carried out by means of the declaration of preferred reporting items for systematic reviews and meta-analyses (PRISMA) is shown in Figure 3. PRISMA allows ordering sequentially from the number of articles in the initial part by the different metadata to the culmination with the quantity, which were 59 articles selected for study. In it, there is the inclusion (IC), EC and other characteristics of the Prism.

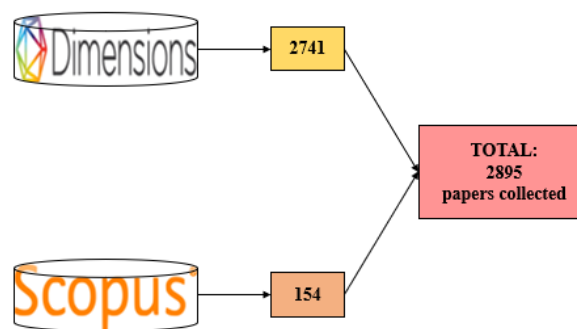


Figure 2. Study search results

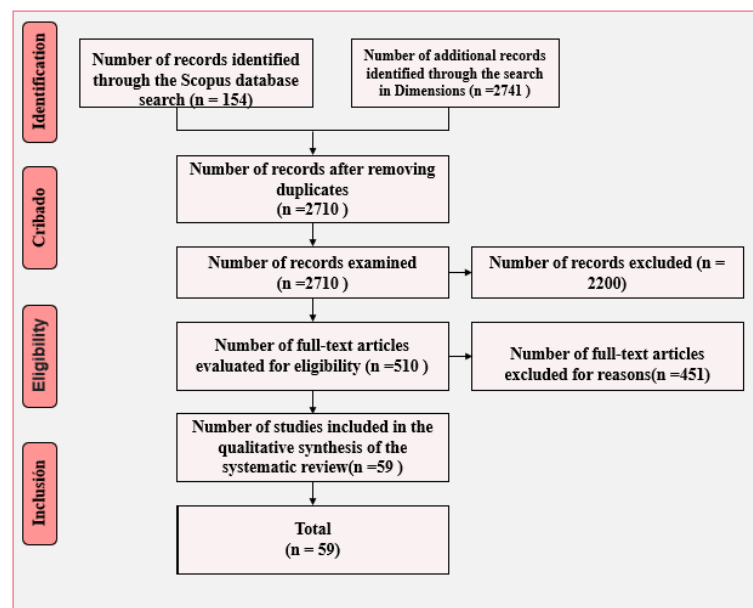


Figure 3. Study selection process flow chart

### 3.3. Generic form

In Figure 4, it was analyzed using the visualization network by co-occurrence and keywords: where the minimum number of occurrences of a keyword is 5; of 7,296 keywords, 687 meet the threshold. For every 687 keywords the total strength of the co-occurrence of links with other keywords will be calculated; the number of keywords selected are 687. On the other hand, it is formed by 8 clusters; where the most outstanding cluster is the one in red with the compound word learning style. It has 37,459 links with a total links strength of 117,104. Likewise, the human word and medical education emerge. This allows us to take this variable into account since the learning style cannot do without a study of the human and medical side. The person is a social being, and as such they must be taken into account for their analysis.

### 3.4. Specific form

Table 3 shows the learning style and the three categories under study. These selected categories answer the research questions. On the other hand, Table 4 shows academic performance and its relationship with learning styles. Table 5 shows the different teaching strategies for the different learning styles. In this way, their relationship between them can be analyzed in depth. Finally, Table 6 shows the skills of the students and the different learning styles. With this, it will be possible to analyze the different competences developed by the student and the different learning styles. In Figure 5, the visualization by colors is observed through the years, we can observe that recent studies stand out with the color yellow and the words higher education in the

context of COVID-19 and learning, that means that to make a study of style of learning, the international and national context must be taken into account. In addition, in Figure 6, the visualization by density is observed where the one that emerges the most is the higher education sector and the style of teaching that are in purple and in the other sector that is green, learning and the human part. This means that the development of soft skills is a very important factor in the development of students. Figure 7 shows the documents published by country, where the United States has the largest publication by far, second only to China. This is because learning style models are most frequently studied in the United States. In addition, in Figure 8, the visualization is the scientific production by continents and countries, which is dark blue in color is of greater production and the one in lead color has almost zero or zero production. It is observed that America is the most outstanding and Asia has had little contribution.

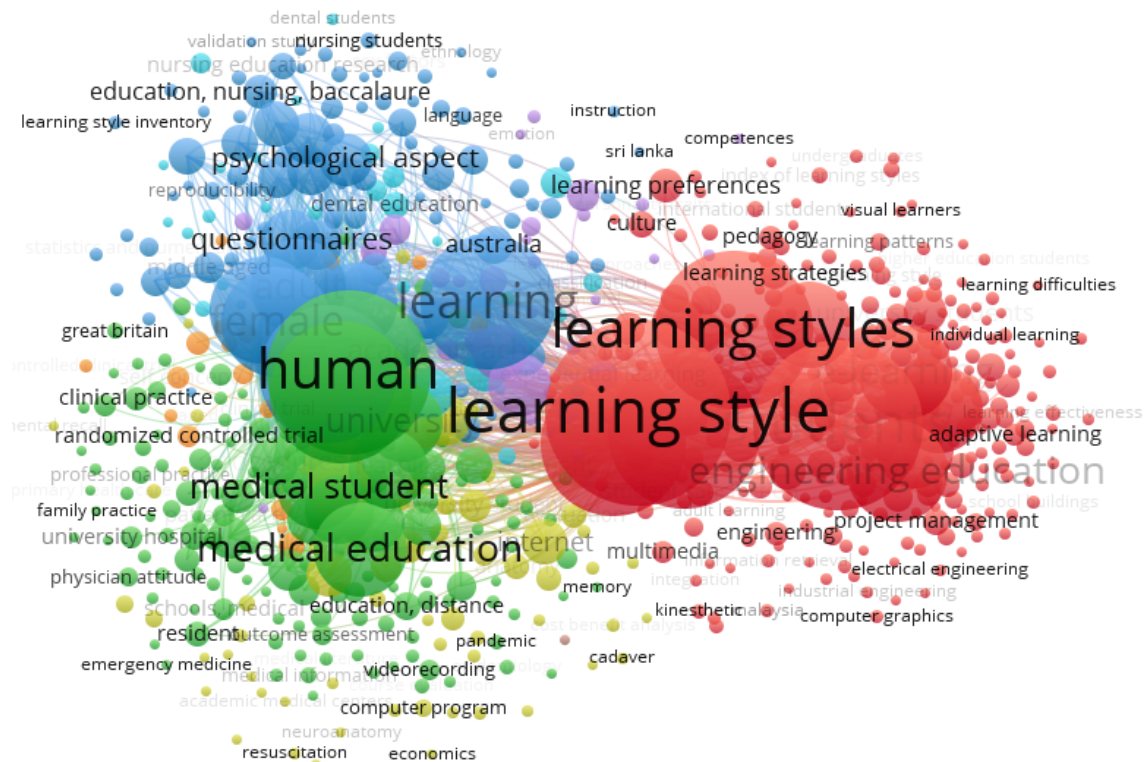


Figure 4. Network visualization

Table 3. Learning styles

Categories	Concepts	References
Academic performance	They are abilities that students develop in numerical skills, writing, reading, and writing.	[4]-[16]
Teaching strategy	They are planning processes that are carried out in the educational sector to improve their academic performance. This can be achieved by applying didactics in teaching, as well as various techniques in the class session	[15], [17]-[53]
Competence	It is the ability to develop the cognitive, procedural and attitudinal part of the student.	[53]-[70]

Table 4. Academic performance and learning style

Features	Concepts	References
Number skills	It is the ability to solve mathematical and logical problems through creativity and reflection.	[4]-[9], [11], [14]-[16]
Social skills	It is the ability to listen, assertiveness, empathy in social settings.	[4], [6]
Skills in reading and writing	It is the ability of people in reading comprehension, as well as the analytical ability of writing development.	[10], [12], [13]

Table 5. Teaching strategy and learning style

Strategies	Concepts	References
Didactics and techniques	They are the didactic resources and the techniques to use according to the learning style.	[15], [24]-[34], [49]-[53]
Technological tools	They are those technological tools that are used in teaching and learning.	[17]-[23]
Project based learning	It is a form of learning, where students learn by doing different roles for the development of projects in a group.	[35]-[47], [51]

Table 6. Competence and learning style

Capabilities	Concepts	References
Conceptual	It is the theoretical way in which students develop their abilities.	[53]-[58]
Procedural	The development of students' abilities is in a practical way developed with their classmates.	[59]-[64], [69], [70]
Attitudinal	Development of values, behavior to be an integral person.	[48], [65]-[68]

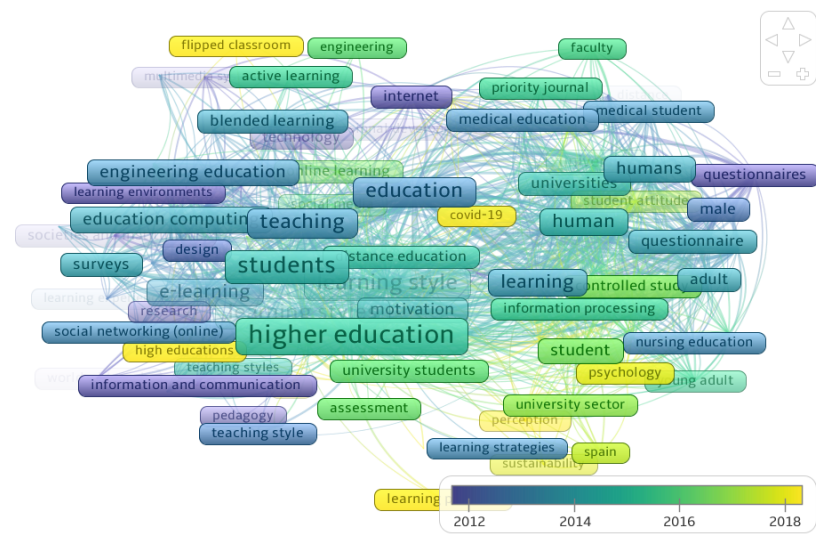


Figure 5. Overlay visualization

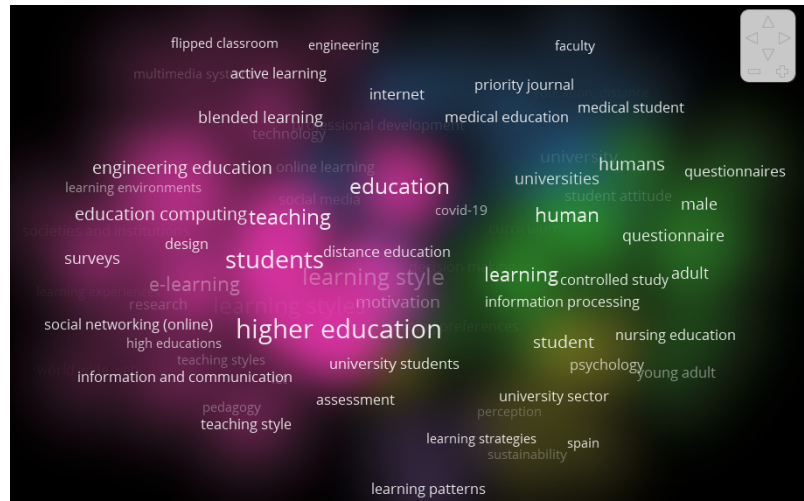


Figure 6. Density visualization



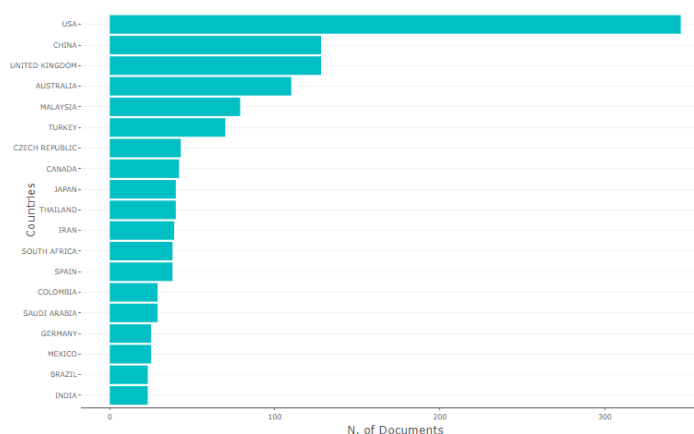


Figure 7. Documents by country

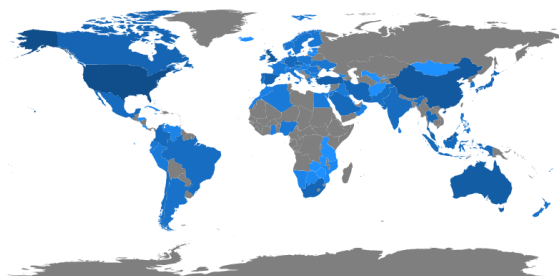


Figure 8. Scientific production

## 4. DISCUSSION

### 4.1. Question

#### 4.1.1. Q1: How is academic performance related to learning styles?

The problem under study has been identified in the formation of learning teams, with the aim of establishing mixed learning styles as a strategy for the formation of efficient and effective teams [6]-[8]. For which, the qualitative approach with non-experimental design was considered; having carried out a pre-test and a post-test for conceptual understanding. In addition, an improvement in said understanding was achieved, which was validated by the analysis of variance (ANOVA) with a significance level of 5%, which favored the work carried out. Therefore, it is concluded that the formation of strategic teams promotes a favorable approach to increase the learning capacity of students. In addition, the students' academic performance is favorable when it is done as a team, since students are social beings [4], [6]. Research by Rezigalla and Ahmed [4] finds that the visual learning style is distributed in the different levels of study. In addition, adequate strategies were carried out for students to advance in their academic performance, taking into account the different learning styles. This will be reflected in the different ways that the student increases their academic performance, either with numerical and social skills [6], [7].

The study of learning styles is important since it allows determining the different learning styles of the students. The study was carried out on 132 students from two higher education institutions. The questionnaire carried out was based on the sensory part of the students carrying out the visual, auditory, read/write, and kinaesthetic (VARK) model oriented to motivation. The result obtained is that a superficial approach to learning predominates. Regarding the VARK model, visual and auditory learning styles are the least frequent [6]. This research has underlined the need to determine student preferences regarding learning styles in accounting education, which will allow further improvement in teaching. In accounting, in one way or another, it is subject to numerical skills for costs, budget, and income. In addition, in the different programs there are students whose numerical skills are quickly developed by the teacher's tutoring. In this way, the development of these skills allows us to be more creative in solving problem [6]-[9].

The aim of this study was to analyze the different language learning styles. It was conducted on 385 freshmen in Vietnam. The adapting reid questionnaire is for data collection to see how you respond and recover through emails using the Google form [7]. The results revealed that the first-year students were active learners, as they mostly belonged to 4 major learning styles, namely tactile, auditory, group and kinesthetic learners, and 2 minor learning styles, i.e. visual learners and individual. The research findings provide resourceful references for English language teaching and learning stakeholders' policy formation, English teachers, and future studies. Writing and writing is very important not only in the English course but in general. Writing allows you to develop your linguistic, interpersonal and intrapersonal skills [10], [12], [13].

By surveying 150 college students from Tezpur University on the academic performance of students in the first semester. They were analyzed applying simple regression, multiple regression and one-way ANOVA. Bearing in mind that 34-36% of students have metacognitive abilities above average [11], [14]. The metacognitive ability explains only 43% of the variability of the academic performance of undergraduate students, which implies that the metacognitive abilities of undergraduate students influence and determine their academic performance to a certain extent. However, the learning style of the university student does not take into account the variation in metacognitive abilities. Therefore, it is suggested that metacognitive skills should be integrated into the curricular components and learning strategy that will help students to monitor and regulate their own learning to meet the challenges of the academic society. In this way, the development of academic performance in its different skills such as writing, numerical skills can be improved depending on the established curricular part [9], [11].

To achieve quality in adaptive education, it is important to study the instruments that are applied to avoid bias in the measurement of learning styles [15]; for which, it was proposed to determine the accuracy of the learning style instruments and with a sample of 150 students. In the first place, a new learning style instrument was developed with the use of figures, graphs and equations [6]-[9], [11], [14]; which was applied, and then the same was done with the VARK instrument. In addition, the results of both were compared, determining that in the preferred learning styles of the students, there were significant differences; therefore, the alternative hypothesis was confirmed, which indicates that using different forms of information; As it is, visual and active content to build learning style instruments have a significant impact on the measurement of learning preferences. Similarly, Lwande *et al.* [16], points out that research does not usually study learning styles and cognitive traits at the same time; therefore, the objective of establishing a method to estimate these two aspects through a learning management system was proposed; having designed a model to collect access information from learning management systems. The study had a sample of 200 students and was able to demonstrate that it is feasible to measure cognitive traits and learning styles in educational management. Likewise, it determined that there is a relationship between learning styles and their social interactions [4], [6], because students valued audiovisual content more, especially auditory content.

It is concluded that academic performance is directly related to learning style, not only in numerical skills and writing. Also in the social skills that is part of the integral formation of the students. Said academic performance will depend on the pedagogical guidelines of the universities. Since this will land in the training of their teachers through their coordinators.

#### **4.1.2. Q2: How are teaching strategies related to learning styles?**

The learning styles of Kolb, Honey and Munford, Felder and Silverman and the VARK model, with the aim of discussing these learning style models and obtaining better conclusions, used the qualitative approach and non-experimental design. In addition, it was carried out as part of the development of a new educational platform [17]-[23]. For this, appropriate techniques must be applied so that it is complemented with the use of the platform [24]-[26], [48]. Likewise, analyzed the non-prespecialty due to the pandemic situation that affects the world from 2020 to the present and was aimed at determining how the electronic learning system with the Moodle platform has facilitated the application of student learning styles; in such a way that they have allowed to acquire knowledge, skills and values. In addition, it applied the mixed approach and non-experimental design; allowing you to determine that the development of technology, educators and students are becoming strongly involved towards e-learning applications. In addition, it concludes that an efficient user interface for the Moodle-based e-learning system facilitates, to a statistically reasonable degree, the improvement of student learning styles [15], [48]-[50].

In the same sense, Shamsuddin and Kaur [49] state that in order to optimize the learning outcome and the cost of programs, the blended learning style is part of the educational system. In this regard, he investigated



the learning styles among students and their perception of blended learning [29], [30], [52]. For which, it involved 119 students who were taking the Diploma course in information technology at a private university; taking into account Kolb's learning styles model and learning perceptions, this is how it was investigated combining elements of process, content and ease of use; using ANOVA to assess students' perceptions of blended learning. Likewise, they determined that the majority of students are part of the convergent category, followed by divergent, accommodating and assimilating; these findings could benefit teachers in designing the most appropriate resources based on the students' preferred mode of learning [27], [28], [33], [34].

In the same vein, research by Costa *et al.* [51] considers that distance education (ED) linked to the use of virtual learning environments (EVA), as interaction tools between the student and the teacher, has become a world-wide research space for techniques to improve the effectiveness of learning in virtual environments; that seek to identify connections between pedagogy and educational technology [31], [32]. According to what was expressed, this research sought to link the theory of learning styles with the behavior of the ED student, showing their interaction with the EVA and trying to associate them with their learning style identified by the Honey-Alonso learning styles questionnaire (CHAEA). Additionally, it was applied to a group of ED students and the correlation between the visual analogue scale (VAS) and the students' learning styles was validated.

Kolb's model is used to identify the learning style of engineering students; on which, there are no studies published in Portugal [50]. In addition, the research was applied to students who had just started their courses in a Portuguese Engineering School, with the aim of evaluating if there is a predominant learning style and if there are differences in the learning style between the students of the industrial administration course and of the technological engineering course. It is worth mentioning that findings were determined that will improve classroom practices to achieve efficiency in the teaching-learning process and the way in which students overcome the difficulties of understanding and comprehension of the topics covered during class sessions [40], [41]. This can be achieved when teaching is not done in the traditional way but instead applies strategies such as project-based learning that allows students to develop a team project fulfilling different roles such as the leader [35], [36], [42], [43].

In the same context, consider that providing quality education implies planning and carrying out educational activities. For this, it is necessary to understand and modify the learning styles of students. It is concluded that collaborative learning based on projects [44]-[47], it allows to have a broader vision with the intervention of all those involved when solving a problem not individually but on the contrary as a group. In addition, the techniques that can be used in class sessions by the teacher help students with their learning styles to learn quickly with the support of technological tools [37]-[39].

#### **4.1.3. Q3: How are competencies acquired by students according to learning styles?**

It is important for teachers to be able to identify the methods that work best for their students. Managing styles will help promote learning and adapt the most appropriate method for each one [60], [61], in this way they will achieve their academic goals and their personal success. At university, when learning, each student follows their own individual pace and their own strategies. The skills used to build learning are unique and personal to each one. Those different methods that each student uses to learn something, sometimes even unconsciously, are their learning styles [55], [56]. Due to this, teachers must perceive, organize and assimilate the styles of our students during the experiences of the class sessions in which learning is built [59], [62]. Knowing the learning styles opens multiple possibilities of action as teachers, with the aim of achieving significant learning, for the construction of cognitive thinking [53], [54], [57], [58] by the students. Therefore, more research is needed to provide recommendations on how to approach students with methods that avoid demotivation [48], [68] and even the desertion of subjects such as mathematics.

The society needs proactive teachers who identify the learning styles of their students with multiple intelligences [65]-[67]. It is concluded that the attitudinal part allows the development of the students' competences to be integral. Although it is true that the cognitive part is very important for the development of the student; but it would have a comprehensive panorama of being developed in values, ethics; in development as a person, who is aware of how to be a collaborative person, who contributes to his society by developing activities that respond to social problems, social pollution and the objectives of sustainable development. Competences are acquired in students according to what has been established in the curricular plan of each university; what comes to do the north of the graduate profile [63], [64]. The skills acquired by the students will depend on the different learning styles that are applied in the class sessions of the different subjects [69], [70].

## 4.2. Proposed model

Figure 9 shows the proposed model after analyzing the subject in depth. The three categories analyzed are located on the right side of the mental map; and on the left the selected models of learning styles; they are the most relevant of all models. The blue curve indicates the direct relationship between the teaching strategy and the Bandeler and Grinder model, since academic performance can be analyzed taking into account the multiple intelligences of the students. Likewise, it is also related to the Kolb model for the way of ordering ideas in writing, making appropriate decisions for the development of social skills, among others. On the other hand, the teaching strategies are related to the Bandler and Grinder model; since in the students the visual, auditory and tactile predominate one more than another. Regarding the competition, it is related to the Honey model. For example, the procedural is related to the pragmatic, the conceptual to the theoretical. This proposed model will allow contributing to university education; how learning styles with their categories are related to some models studied in different contexts. Although it is true that the relationship can occur in all of them, priority has been given to where the relationship is strongest.

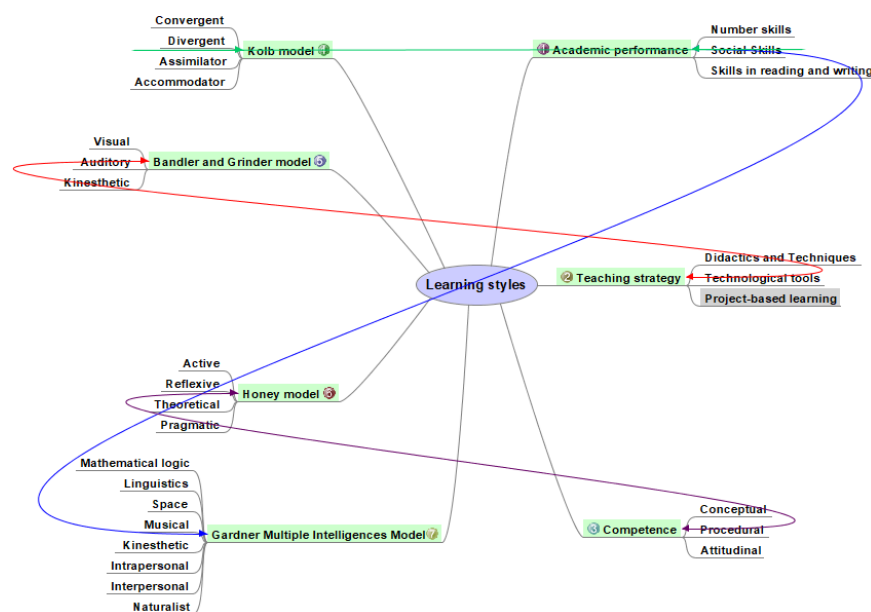


Figure 9. Proposed model of university learning style

## 5. CONCLUSION

The study carried out allowed an in-depth analysis of the learning style and categories such as academic performance, teaching strategy and skills. Academic performance is related to learning styles, in terms of numerical skills, reading and writing. In addition, the teaching strategy and learning style, the teacher plays a very important role by applying different strategies depending on the nature of the courses and the different ways of learning of the student. Regarding the skills acquired by students, this is done in a cognitive way where the student acquires knowledge and then puts it into practice; this complemented with a comprehensive training through their attitudes through ethics and morals. On the other hand, it was obtained an innovative and creative model since the proposal is a contribution that will allow it to be used in different parts of the world, taking as criteria its educational model and its pedagogical guidelines, in order to adequately reflect it in its curricular design of the different study programs. Also, the use of bibliometrix and the VOSviewer allowed optimal analysis through maps and networks. It is suggested as future work they can continue to adapt the proposed model through continuous improvement. For this, the study must be interdisciplinary and multidisciplinary.

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## REFERENCES




- [1] E. F. Medina, Y. P. Somoza, L. Andrade-Arenas, J. C. Zavaleta, R. Y. Alva, and S. V. Vargas, "Analysis of distance learning in the professional school of systems engineering and informatics," *International Journal of Advanced Computer Science and Applications*, vol. 12, no. 7, pp. 543–552, 2021, doi: 10.14569/IJACSA.2021.0120763.
- [2] C. B. Agaton and L. J. Cueto, "Learning at home: parents' lived experiences on distance learning during COVID-19 pandemic in the Philippines," *International Journal of Evaluation and Research in Education (IJERE)*, vol. 10, no. 3, pp. 1–911, Sep. 2021, doi: 10.11591/ijere.v10i3.21136.
- [3] N. D. S. Chetty, L. Handayani, N. A. B. Sahabudin, Z. Ali, N. Hamzah, and S. Kasim, "Learning styles and teaching styles determine students' academic performances," *International Journal of Evaluation and Research in Education (IJERE)*, vol. 8, no. 4, pp. 610–615, Dec. 2019, doi: 10.11591/ijere.v8i4.20345.
- [4] A. A. Rezigalla and O. Y. Ahmed, "Learning style preferences among medical students in the College of Medicine, University of Bisha, Saudi Arabia (2018)," *Advances in Medical Education and Practice*, vol. 10, pp. 795–801, Sep. 2019, doi: 10.2147/AMEP.S219176.
- [5] T. D. Atalay, "Learning styles and teacher efficacy among prospective teachers based on diverse variables," *International Journal of Evaluation and Research in Education (IJERE)*, vol. 8, no. 3, pp. 484–494, Sep. 2019, doi: 10.11591/ijere.v8i3.19609.
- [6] K. Berková, J. Borůvková, D. Frendlovská, and P. Krpálek, "Learning styles of Czech College and University students in accounting education," *Universal Journal of Educational Research*, vol. 8, no. 8, pp. 3459–3468, Aug. 2020, doi: 10.13189/ujer.2020.080820.
- [7] T. V. Vu and D. N. Tran, "Demystifying perceptual learning style preferences of Vietnamese University freshmen in english academic achievement," *International Journal of Learning, Teaching and Educational Research*, vol. 19, no. 9, pp. 15–38, Sep. 2020, doi: 10.26803/ijlter.19.9.2.
- [8] S. Wang and C. Han, "The influence of learning styles on perception and preference of learning spaces in the university campus," *Buildings*, vol. 11, no. 12, pp. 1–13, Nov. 2021, doi: 10.3390/buildings11120572.
- [9] M. A. Al-Ghamdi, "Undergraduate EFL students' perceptions about their experiences attending online classes during the COVID-19 pandemic at a Saudi University," *English Language and Literature Studies*, vol. 12, no. 2, pp. 67–73, Apr. 2022, doi: 10.5539/ells.v12n2p67.
- [10] E. Simangunsong, "Learning style preference: results of repetitive cross-sectional surveys in an higher education institution," *JPI (Jurnal Pendidikan Indonesia)*, vol. 9, no. 4, pp. 730–741, Dec. 2020, doi: 10.23887/jpi-undiksha.v9i4.21414.
- [11] I. N. Hidayati, "Meaningful and memorable learning: integrating TPR and YouTube videos to teach vocabulary," *International Journal of Quantitative Research and Modeling*, vol. 1, no. 2, pp. 100–111, Jun. 2020, doi: 10.46336/ijqrm.v1i2.37.
- [12] F. Novel, C. R. P. Ajiuksmo, and S. Supriyanti, "The influence of processing and regulation of learning on academic achievement amongst first year undergraduate psychology students in university of North Sumatra," *Asian Journal of University Education*, vol. 15, no. 2, pp. 36–51, Dec. 2019, doi: 10.24191/ajue.v15i2.7555.
- [13] F. Afkhaminia, H. Siamian, N. Behnampour, A. Moghimi, and S. Karimpour, "Study of student success indicators based on the viewpoints of the students of Mazandaran University of Medical Sciences," *Acta Informatica Medica*, vol. 26, no. 2, pp. 175–179, 2018, doi: 10.5455/aim.2018.26.175-179.
- [14] J. Kittur and M. Salunke, "Mixed learning styles: a strategy for team formation," *Journal of Engineering Education Transformations*, vol. 33, pp. 434–441, Jan. 2020, doi: 10.16920/jeet/2020/v33i0/150194.
- [15] A. Alzain, S. Clark, G. Ireson, and A. Jwaid, "Adaptive education based on learning styles: are learning style instruments precise enough?," *International Journal of Emerging Technologies in Learning (IJET)*, vol. 13, no. 9, pp. 41–52, Sep. 2018, doi: 10.3991/ijet.v13i09.8554.
- [16] C. Lwande, L. Muchemi, and R. Oboko, "Identifying learning styles and cognitive traits in a learning management system," *Heliyon*, vol. 7, no. 8, pp. 1–9, Aug. 2021, doi: 10.1016/j.heliyon.2021.e07701.
- [17] S. Rahimi, Y. Sohrabi, A. H. Nafez, and M. Dabirian, "Learning styles in university education (systematic review)," *Indian Journal of Public Health Research & Development*, vol. 8, no. 2, pp. 386–391, 2017, doi: 10.5958/0976-5506.2017.00146.2.
- [18] S. Yosravevorakul, M. Ekkayokkaya, S. Sangsuwan, L. van Lier, and R. G. Hatfield, "Learning styles of ASEAN students: a pilot case study of thai freshmen in English major at the school of liberal arts, Mae Fah Luang university," *International Journal of Applied Engineering Research*, vol. 12, no. 24, pp. 14889–14894, 2017.
- [19] P. P. Sun and L. S. Teng, "Profiling perceptual learning styles of Chinese as a second language learners in university settings," *Journal of Psycholinguistic Research*, vol. 46, no. 6, pp. 1529–1548, Dec. 2017, doi: 10.1007/s10936-017-9506-y.
- [20] D. A. Yousef, "Learning style preferences of undergraduate students: the case of the American University of Ras Al Khaimah, the United Arab Emirates," *Education and Training*, vol. 60, no. 9, pp. 971–991, Oct. 2018, doi: 10.1108/ET-08-2017-0126.
- [21] D. A. Yousef, "Learning style preferences of postgraduate students: the case of the British University in Dubai, the United Arab Emirates," *Journal of International Education in Business*, vol. 11, no. 2, pp. 291–311, Nov. 2018, doi: 10.1108/JIEB-02-2018-0006.
- [22] J. Thanyaphongphat and P. Panjaburee, "Effects of a personalised ubiquitous learning support system based on learning style-preferred technology type decision model on university students' SQL learning performance," *International Journal of Mobile Learning and Organisation*, vol. 13, no. 3, pp. 233–254, 2019, doi: 10.1504/IJMLO.2019.100379.
- [23] C. Churngchow, N. Rorbkorb, O. Petchurai, and J. Tansakul, "Appropriate learning management for students with different learning styles within a multicultural society at state-run universities in Thailand," *International Journal of Higher Education*, vol. 9, no. 2, pp. 200–208, Jan. 2020, doi: 10.5430/ijhe.v9n2p200.
- [24] O. Navarro, F. J. Sanchez-Verdejo, J. M. Anguita, and A. L. Gonzalez, "Motivation of university students towards the use of information and communication technologies and their relation to learning styles," *International Journal of Emerging Technologies in Learning (IJET)*, vol. 15, no. 15, pp. 202–218, Aug. 2020, doi: 10.3991/ijet.v15i15.14347.
- [25] N. Anuar, N. Abdullah, and S. N. S. Hod, "Pre-university students' learning styles and attitude towards mathematics achievements," *Advances in Science, Technology and Engineering Systems Journal*, vol. 5, no. 6, pp. 269–273, 2020, doi: 10.25046/aj050632.
- [26] P. N. B. Mancilla, V. M. S. Backes, and B. P. Canever, "Learning styles: preference of the nursing students of the University of Magallanes, Chile," *Texto & Contexto-Enfermagem*, vol. 29, pp. 1–12, 2020, doi: 10.1590/1980-265x-tce-2019-0265.
- [27] F. J. P. Estrada, F. J. García-Prieto, and S. Conde-Vélez, "Learning styles in university students: types of strategies, materials, supports, evaluation and performance. Case study," *European Journal of Contemporary Education*, vol. 9, no. 2, pp. 394–416, Jun.

- 2020, doi: 10.13187/ejced.2020.2.394.
- [28] A. Durmus and M. Güven, "The relationship between teaching styles of English instructors and learning styles of English prep class students at a Turkish State University," *Asian Journal of University Education*, vol. 16, no. 3, pp. 15–26, Oct. 2020, doi: 10.24191/ajue.v16i3.8603.
  - [29] M. M. Al-Yassiry, F. K. Aloraibi, and H. S. Q. Alhilfi, "Teaching-learning styles & aids student's preferences among first year undergraduate medical students in the college of medicine, university of Missan, Iraq," *Indian Journal of Forensic Medicine & Toxicology*, vol. 15, no. 1, pp. 1346–1353, Jan. 2021, doi: 10.37506/ijfmr.v15i1.13601.
  - [30] A. bin Eid et al., "Examining learning styles with gender comparison among medical students of a Saudi university," *Advances in Medical Education and Practice*, vol. 12, pp. 309–318, Mar. 2021, doi: 10.2147/AMEP.S295058.
  - [31] S. A. A. Rahman, H. W. Ali, G. Rasool, and I. Siddique, "Effect of learning styles on self-esteem and stress levels of university students," *Pakistan Journal of Medical and Health Sciences*, vol. 15, no. 2, pp. 469–472, 2021.
  - [32] M. Fakharzadeh and N. Amini, "The relationships between web-based information credibility judgment, critical thinking, and learning styles of Iranian EFL university students," *Applied Research on English Language*, vol. 10, no. 2, pp. 133–154, 2021, doi: 10.22108/ARE.2021.128027.1704.
  - [33] V. I. Ballesteros-Espinoza, M. Rodríguez-Rosa, A. B. Sánchez-García, and P. Vicente-Galindo, "Proposal of the dichotomous STATIS DUAL method: software and application for the analysis of dichotomous data, applied to the test of learning styles in university students," *Mathematics*, vol. 9, no. 21, pp. 1–14, Nov. 2021, doi: 10.3390/math9212797.
  - [34] M. N. Espericueta-Medina, L. Sánchez-Rivera, M. C. Cepeda-Gonzalez, and J. Mireles-Palomo, "College student learning styles and interests in times of pandemic," *Journal of Technological Development*, vol. 5, no. 15, pp. 23–32, Jun. 2021, doi: 10.35429/JTD.2021.15.5.23.32.
  - [35] N. R. Vajjhala and K. D. Strang, "Impact of information communication technology strategies on learning effectiveness," *International Journal of Online Pedagogy and Course Design*, vol. 12, no. 1, pp. 1–14, Feb. 2022, doi: 10.4018/IJOPCD.292026.
  - [36] C. M. A. Medina and A. M. G. Restrepo, "Learning styles of ethnic minority students: a matched case-control study in a dental school in Latin America," *CES Odontología*, vol. 34, no. 1, pp. 25–34, Jun. 2021, doi: 10.21615/cesodon.34.1.3.
  - [37] K. D. Lestari and S. Asari, "Screen book versus printed book: a comparative study on the influence of students perceived learning at six semesters on English Department in University of Muhammadiyah Gresik," *Journal of English Teaching, Literature, and Applied Linguistics*, vol. 4, no. 2, pp. 73–83, Aug. 2020, doi: 10.30587/jetla.v4i2.2268.
  - [38] E. Eika, "Learning in higher education under the Covid-19 pandemic: were students more engaged or less?," *International Journal of English Linguistics*, vol. 11, no. 3, pp. 96–120, May 2021, doi: 10.5539/ijel.v11n3p96.
  - [39] H. C. Hung and S. S. C. Young, "Unbundling teaching and learning in a flipped thermal physics classroom in higher education powered by emerging innovative technology," *Australasian Journal of Educational Technology*, vol. 37, no. 4, pp. 89–99, May 2021, doi: 10.14742/ajet.6059.
  - [40] J. Yu, J. D. Vermunt, and C. Burke, "Students' learning patterns and learning spaces in higher education: an empirical investigation in China," *Higher Education Research & Development*, vol. 40, no. 4, pp. 868–883, Jun. 2021, doi: 10.1080/07294360.2020.1775557.
  - [41] T. Gál, P. Popovics, and G. Á. Ványi, "Learning motivations, styles and expectations of students – a survey at the University of Debrecen," *Applied Studies in Agribusiness and Commerce*, vol. 12, no. 1–2, pp. 41–46, May 2018, doi: 10.19041/APSTRACT/2018/1-2/6.
  - [42] E. Nagumo, L. F. Teles, and L. de A. Silva, "utilização de vídeos do Youtube como suporte ao processo de aprendizagem (in Portuguese)," *Revista Eletrônica de Educação*, vol. 14, pp. 1–12, Jan. 2020, doi: 10.14244/198271993757.
  - [43] L. E. Pettersson, "Mobile-assisted learning and higher-education ESP: English for physiotherapy," *Lingua Posnaniensis*, vol. 60, no. 1, pp. 81–94, Jun. 2018, doi: 10.2478/linpo-2018-0006.
  - [44] W. Labib, I. Pasina, A. Abdelhadi, G. Bayram, and M. Nurunnabi, "Learning style preferences of architecture and interior design students in Saudi Arabia: a survey," *MethodsX*, vol. 6, pp. 961–967, 2019, doi: 10.1016/j.mex.2019.04.021.
  - [45] M. Andrew, J. Taylorson, D. J. Langille, A. Grange, and N. Williams, "Student attitudes towards technology and their preferences for learning tools/devices at two universities in the UAE," *Journal of Information Technology Education: Research*, vol. 17, pp. 309–344, 2018, doi: 10.28945/4111.
  - [46] M. A. C. Canale et al., "El uso de redes sociales como instrumento innovador en la educación universitaria: Facebook como herramienta de aprendizaje colaborativo en la asignatura de inmunología (In Spanish)," *Revista de Innovación y Buenas Prácticas Docentes*, no. 4, pp. 32–48, Dec. 2017, doi: 10.21071/ripadoc.v4i0.10494.
  - [47] V. V. Viet and D. T. T. Phuong, "Factors influencing the academic performance of the students," *VNU Journal of Science: Education Research*, vol. 33, no. 3, pp. 27–34, Sep. 2017, doi: 10.25073/2588-1159/vnuer.4070.
  - [48] M. Priyaadharshini and B. V. Sundaram, "Evaluation of higher-order thinking skills using learning style in an undergraduate engineering in flipped classroom," *Computer Applications in Engineering Education*, vol. 26, no. 6, pp. 2237–2254, Nov. 2018, doi: 10.1002/cae.22035.
  - [49] N. Shamsuddin and J. Kaur, "Students' learning style and its effect on blended learning, does it matter?," *International Journal of Evaluation and Research in Education (IJERE)*, vol. 9, no. 1, pp. 195–202, Mar. 2020, doi: 10.11591/ijere.v9i1.20422.
  - [50] M. Sousa and E. Fontão, "Exploring learning styles in a Portuguese engineering school: are they different in different courses?," *International Journal of Engineering Pedagogy (iJEP)*, vol. 10, no. 6, pp. 78–94, Dec. 2020, doi: 10.3991/ijep.v10i6.15237.
  - [51] R. D. Costa, G. F. Souza, R. A. M. Valentim, and T. B. Castro, "The theory of learning styles applied to distance learning," *Cognitive Systems Research*, vol. 64, pp. 134–145, Dec. 2020, doi: 10.1016/j.cogsys.2020.08.004.
  - [52] I. Solikhah, "Digital textbook in English for academic purposes and its relationships to learning styles among Indonesian university students," *TESOL International Journal*, vol. 16, pp. 221–239, 2021, doi: 10.30957/repo.69.
  - [53] M. Malcik and M. Miklosikova, "Learning styles of students as a factor affecting pedagogical activities of a university teacher," *International Journal of Emerging Technologies in Learning (IJET)*, vol. 12, no. 2, pp. 210–218, Feb. 2017, doi: 10.3991/ijet.v12i02.6277.
  - [54] H. Rodríguez et al., "Análisis de los estilos de aprendizaje en alumnos de Medicina de la Universidad de Chile (in Spanish)," *Educación Médica*, vol. 19, no. 1, pp. 2–8, Jan. 2018, doi: 10.1016/j.edumed.2016.11.004.
  - [55] M. K. Afify, "The impact of interaction between timing of feedback provision in distance e-learning and learning styles on achieving learning outcomes among arab open university students," *EURASIA Journal of Mathematics, Science and Technology Education*,




- vol. 14, no. 7, pp. 3053–3068, May 2018, doi: 10.29333/ejmste/91619.
- [56] E. G. Ramírez, A. P. C. Soto, L. Y. C. Chapal, and A. G. Álvarez, “Estilos de aprendizaje de estudiantes de fisioterapia de cursos básicos y prácticas formativas de una universidad en Colombia (in Spanish),” *Educación Médica*, vol. 22, no. 1, pp. 27–33, Jan. 2021, doi: 10.1016/j.edumed.2018.11.002.
- [57] S. H. B. Granados and M. L. A. Jaramillo, “Learning styles and the use of ICT in university students within a competency-based training model,” *Journal of New Approaches in Educational Research*, vol. 8, no. 1, pp. 1–6, Jan. 2019, doi: 10.7821/naer.2019.1.296.
- [58] G. C. Magulod, “Learning styles, study habits and academic performance of Filipino University students in applied science courses: implications for instruction,” *JOTSE: Journal of Technology and Science Education*, vol. 9, no. 2, pp. 184–198, Mar. 2019, doi: 10.3926/jotse.504.
- [59] D. J. Edwards, L. Kupczynski, and S. L. Groff, “Learning styles in problem-based learning environments impacts on student achievement and professional preparation in university level physical therapy courses,” *International Journal of Higher Education*, vol. 8, no. 3, pp. 206–213, Jun. 2019, doi: 10.5430/ijhe.v8n3p206.
- [60] M. G. Baltaoğlu and M. Güven, “Relationship between self-efficacy, learning strategies, and learning styles of teacher candidates (Anadolu University example),” *South African Journal of Education*, vol. 39, no. 2, pp. 1–11, May 2019, doi: 10.15700/saje.v39n2a1579.
- [61] E. Kempen and S. B. Kruger, “Kolb’s learning styles of optometry students at the University of the Free State, South Africa,” *African Vision and Eye Health*, vol. 78, no. 1, pp. 1–6, Jan. 2019, doi: 10.4102/aveh.v78i1.454.
- [62] N. Safaeifard, H. N. Areshtanab, F. Roshangar, H. Ebrahim, H. K. Moonaghi, and R. Janani, “Preferred learning styles of nurses in in-service training courses in Tabriz University of medical sciences,” *Acta Facultatis Medicae Naissensis*, vol. 36, no. 1, pp. 69–78, Mar. 2019, doi: 10.2478/afmna-2019-0007.
- [63] R. Farhang, U. Z. Ahari, S. Ghasemi, and A. Kamran, “The relationship between learning styles and career decision-making self-efficacy among medicine and dentistry students of Ardabil university of medical sciences,” *Education Research International*, vol. 2020, pp. 1–6, Nov. 2020, doi: 10.1155/2020/6662634.
- [64] C. van Petegem et al., “Pass/fail prediction in programming courses,” *Journal of Educational Computing Research*, vol. 61, no. 1, pp. 68–95, Mar. 2023, doi: 10.1177/07356331221085595.
- [65] B. Klimova, K. Zamborova, A. Cierniak-Emerych, and S. Dziuba, “University students and their ability to perform self-regulated online learning under the COVID-19 Pandemic,” *Frontiers in Psychology*, vol. 13, pp. 1–10, Mar. 2022, doi: 10.3389/fpsyg.2022.781715.
- [66] L. Varenina, E. Vecherinina, E. Shchedrina, I. Valiev, and A. Islamov, “RETRACTED: developing critical thinking skills in a digital educational environment,” *Thinking Skills and Creativity*, vol. 41, pp. 1–9, Sep. 2021, doi: 10.1016/j.tsc.2021.100906.
- [67] A. el Dirani, M. Khalil, H. J. Hejase, M. Hashem, Z. Reslan, and F. Shaito, “The incremental effect of students’ engagement, over and above emotional intelligence, on students’ academic achievement,” *Journal of Business Theory and Practice*, vol. 9, no. 1, pp. 17–29, Jan. 2021, doi: 10.22158/jbtp.v9n1p17.
- [68] Y. Suprpto, L. Nurlaela, and S. Masitoh, “The influence of learning style utilization towards experimental learning outcomes of cadets in boarding school/vocational education,” *Journal of Education, Health and Sport*, vol. 9, no. 5, pp. 120–126, 2019, doi: 10.5281/zenodo.2705009.
- [69] S. V. Kolekar, R. M. Pai, and M. M. M. Pai, “Adaptive user interface for moodle based e-learning system using learning styles,” *Procedia Computer Science*, vol. 135, pp. 606–615, 2018, doi: 10.1016/j.procs.2018.08.226.
- [70] J. Stander, K. Grimmer, and Y. Brink, “Learning styles of physiotherapists: a systematic scoping review,” *BMC Medical Education*, vol. 19, no. 1, pp. 1–9, Dec. 2019, doi: 10.1186/s12909-018-1434-5.

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