

# Technology Enhanced Learning and Student Academic Performance at a Public University in Peru

Maritza Arones, Olga M. Curro-Urbano, Carmen Luisa Chauca Saavedra, and Ynés Phun-Pat

**Abstract**—The adaptation of the teaching-learning process to virtuality, supported by the use of the academic platform in order to continue with educational activities, has gradually improved and has been reflected in the student's academic performance. The objective of the research was to analyze the learning strategies used by university students during the learning process enhanced by technology, to identify those used most frequently, as well as the relationships they have with the grade point average obtained in their academic performance. The study group was represented by a sample of 486 students from four academic programs of the Public University of Peru (Universidad Nacional San Luis Gonzaga). It was a mixed-focus study that worked with the ACRA-Abridged questionnaire that was virtually delivered to the student to collect the strategies used for their virtual learning. It is concluded that, despite various problems related to connectivity, they are always motivated to successfully achieve learning, likewise, the training process of the platform's digital tools must continue, as well as guiding the student in their learning virtual.

**Index Terms**—Digital literacy, digital tools, study habit, virtual teaching.

## I. INTRODUCTION

Currently the changes in education have accelerated, many university-level educational institutions are face-to-face, but due to the pandemic caused by COVID 19, they assumed an online education.

The low digital literacy of teachers made it difficult to use the didactic tools offered by the platform of the University under study [1], due to this the teachers were trained in the use of digital tools to adapt the development of their learning sessions To virtuality, however, the student was not trained to improve his learning through technology, to this is added the inequality of access to the Internet service, particularly for those students with low economic resources [2]. These unexpected changes did not allow the redesign of the content to be developed in each subject [3] and with a standardized assessment for all academic programs, obtaining quality academic performance was worrying. When reviewing the literature on technology-enhanced learning and student academic performance, it is shown that the incorporation of technology in learning processes makes students communicate more and share information in the performance of tasks such as in the forum, email, digital platforms (asynchronous communication), use of chat, video calls and videoconferences (synchronous communication) [4]. These

academic activities encourage the formation of study groups, creating a community of students [5], [6] and incorporating learning strategies resulting from group feedback [7]. The reference [8] in his analytical review work on the use of the latest digital technological developments or emerging technologies affect which ones are applied in education from a technical and educational perspective. He also mentions that technology changes so rapidly that at present it is necessary to investigate new models and teaching-learning strategies, taking into account that the application of this technology is wide and considers it can be implemented in all types of education: formal, informal and not formal. On the other hand, the reference [9] applied a survey to students who carry out online studies and a semi-structured interview to teachers, in order to analyze the perceptions and self-perceptions to measure the effect of the COVID-19 pandemic on the academic performance of university students, stating that some academically good students could not perform fully due to lack of high technological competence or access to the necessary hardware, while others show a higher level of confidence and readiness in online learning; There has also been an increase in absenteeism and academic dropouts. The reference [10] in his study on the use of learning strategies in virtual mode and applying the abbreviated ACRA scale concludes that students use more understanding and study habits. In the learning support strategies, they used intrinsic motivation, anxiety control, anti-distracting conditions, social support, work schedule and plan, and also identified that the least used were cognitive and control strategies. Learning, the lowest incidence was perceived in the use of selection, organization, underlining, and awareness of the functionality of the strategies, preparation strategies, planning and control of the response in a situation of evaluation and repetition and rereading. Also [11] carried out an investigation applying the abbreviated ACRA in the collection of information, stating that the students used a significant number of strategies, such as repetition, rereading (acquisition) and social support (support).

The reference [12] argued that whatever the educational model in a university, learning strategies are important for academic success, and the study carried out in humanities degree students obtained the highest average in the study habits dimension ( in the abbreviated ACRA) and is followed by intrinsic motivation; on the other hand [13] using the same questionnaire in Colombian university students, it was identified that the most used strategy is related to social support, motivation, planning and control of tasks.

This transformation of the teaching-learning process has given rise to new strategies adopted and innovated by the

Manuscript received December 12, 2021; revised February 7, 2022.

The authors are with Universidad Nacional San Luis Gonzaga, Peru (e-mail: marones@unica.edu.pe, occurro@unica.edu.pe, carmen.chauca@unica.edu.pe, yphun@unica.edu.pe).

student, developing an active and collaborative learning as a result of the different communication and interaction channels offered by telecommunications [14] and that allows them to culminate with success an academic semester adapted to virtual training [15]. Likewise, it is the Educational Model and the intention of the university, which defines the strategies not only for teaching but also for learning [16], in the current context through technology, collaborative learning finds an instrument to facilitate I work online since the student learns in different spaces and times [17], consequently these technological resources are potentiators of great changes in education and become allies of virtual learning [18], where the student before the variety of resources must evaluate and choose the appropriate tools for their learning [19].

However, technological support in the teaching-learning process requires flexibility, fewer fixed content, new teaching strategies to encourage formative research [20] favoring the incorporation of new knowledge and better results in the student's academic performance, which allow the development of the necessary capacities for lifelong learning [21], updating their knowledge and skills in their practical development, in the face of the difficult and accelerated change of virtual learning [22]. Likewise, it was identified that in virtuality, various resources are offered for the development of the teaching-learning process [23] and achieve a successful result. Likewise, according to Neuroeducation, as a discipline that seeks to optimize teaching and learning processes based on the functioning of the brain, it is known that the frontal area of the brain, where the nervous centers of autonomy and decision-making are located, is the last in developing in the human organism, culminating between 25 to 30 years of age; hence the term "neuroplasticity" is mentioned to indicate that a person can unlearn and learn throughout his life, as mentioned in [24].

The content and results of the research will serve to develop subsequent studies and continue to improve the student's learning strategies, so the present study aimed to analyze the learning strategies used by university students during the learning process improved by the technology, to identify those used most frequently, as well as the relationships they have with the grade point average obtained in their academic performance.

## II. METHODOLOGY

The research was carried out at the National University "San Luis Gonzaga", located in the country of Peru, it is the only public university in the Department of Ica, so it has a population of 1 392 students among the Science Areas of the Health and Social Sciences and Humanities, 402 university professors; A sample of 486 students from the Areas in question whose ages vary between 18 and 26 years was considered, 75.28% are women and 24.72% are men; with a mixed, descriptive-correlational research approach. In collecting the information, the Abbreviated ACRA (ACRA-A) questionnaire for university students (De la Fuente and Justicia, 2003) was used, which aims to evaluate what the student does, based on the student's knowledge

when they learn [25], which allowed us to quantitatively evaluate various learning strategies used by students during the study activity; This is an instrument validated by experts that consists of 44 items comprised in three dimensions: Dimension I: Cognitive strategies and learning control that considers 25 items, Dimension II: Support strategies for learning with 14 items and Dimension III: Habits study with 5 items. The student had the option of choosing the appropriate response through 4 alternatives that were: 1. Never or almost never; 2. Sometimes; 3. Many times and 4. Always or almost always.

The questionnaire was sent digitally via the student's email and through the zoom chat during the teacher's virtual session, also for the student's academic performance an information sheet was used that was applied at the end of the academic semester, taking into account the University Evaluation Regulation that considers the following qualifications: Excellent (20,19 and 18), Very Good (17,16 and 15), Good (14,13 and 12), Approved (11), Disapproved (Minor grades or equal to 10) and Void (zero). Then the data obtained from the variables under study were statistically analyzed and interpreted with the SPSS version 22 program.

## III. RESULTS

The platform used by the University allowed teachers and students to publish content in forums, tasks and evaluations; activities that were designed for all programs in a general way and that have served to analyze the results. On the other hand, the ACRA-A questionnaire was applied to students from four academic programs: Biology, Nursing, Dentistry, and Education Sciences and Humanities; obtaining the results as shown in table I, the average of the four academic programs with respect to the three dimensions is almost similar, with a slight increase in the average of the use of study habits strategies (average of 3.06). In descending order, it is followed by the use of learning support strategies (average of 2.98) and lastly, cognitive and learning control strategies (average 2.91).

TABLE I: DESCRIPTIVE STATISTICS OF ACADEMIC PROGRAMS AND USE OF LEARNING STRATEGIES

| Dimensions                                | Academic program                  | Half | Students |
|---|-----------------------------------|------|----------|
| Cognitive and learning control strategies | Biology                           | 2.89 | 93       |
|   | Nursing                           | 3.03 | 141      |
|   | Odontology                        | 2.97 | 145      |
|   | Education Sciences and Humanities | 2.75 | 107      |
|   | Total                             | 2.91 | 486      |
| Learning support strategies               | Biology                           | 2.89 | 93       |
|   | Nursing                           | 3.19 | 47       |
|   | Odontology                        | 3.04 | 31       |
|   | Education Sciences and Humanities | 2.79 | 107      |
|   | Total                             | 2.98 | 486      |
| Study habits                              | Biology                           | 3.11 | 93       |
|   | Nursing                           | 3.11 | 47       |
|   | Odontology                        | 3.03 | 31       |
|   | Education Sciences and Humanities | 3.00 | 107      |
|   | Total                             | 3.06 | 486      |

Likewise, the result regarding the academic performance of the student indicates that the most representative sample is the Very good level with 61%, qualifications that in the vigesimal system and Evaluation Regulation of the University under study, corresponds to the interval [15]-[17], as shown in figure 1. Likewise, 24% of students have an excellent grade [18]-[20], 14% in good [12]-[14] and only 1% in disapproved.

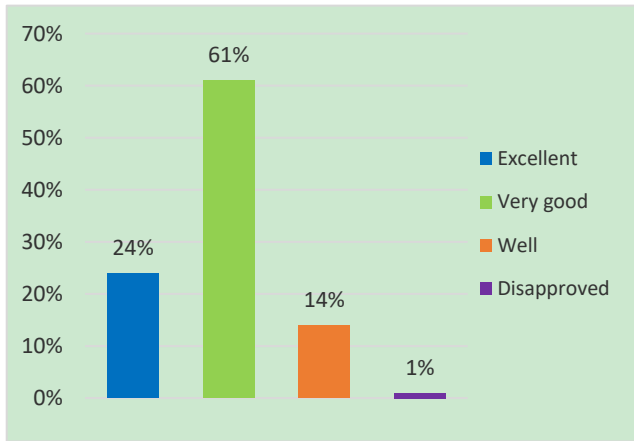


Fig. 1. Classification of students' academic performance.

TABLE II: MEASURES OF MEANS REGARDING THE LEARNING TACTICS USED BY THE STUDENTS

| Tactics              | Academic programs   |         |            |                                  |
|----------------------|---------------------|---------|------------|----------------------------------|
|                      | Biological Sciences | Nursing | Odontology | Education Science and Humanities |
|                      | Average             | Average | Average    | Average                          |
| Exploration          | 3.06                | 3.27    | 3.15       | 3.00                             |
| Fragmentation        | 2.83                | 2.99    | 2.97       | 2.62                             |
| Groupings            | 2.65                | 2.86    | 2.67       | 2.56                             |
| Encoding search      | 2.98                | 3.06    | 3.10       | 2.80                             |
| Search for clues     | 2.79                | 3.07    | 3.00       | 2.79                             |
| Response planning    | 3.02                | 3.03    | 2.95       | 2.82                             |
| Written answer       | 2.89                | 3.34    | 3.16       | 2.90                             |
| Self-knowledge       | 3.00                | 3.06    | 3.03       | 2.89                             |
| Shared relationships | 2.70                | 3.02    | 3.06       | 2.73                             |
| Self driven          | 2.93                | 3.16    | 3.06       | 2.86                             |
| Affective            | 2.85                | 3.22    | 3.01       | 2.94                             |
| Social interactions  | 2.91                | 3.09    | 2.96       | 2.95                             |
| Motivation           | 3.09                | 3.38    | 3.24       | 2.92                             |
| Repetition           | 3.14                | 3.21    | 3.10       | 3.00                             |
| Paraphrase           | 3.16                | 2.94    | 3.10       | 2.81                             |

In table II, there are the tactics corresponding to each dimension of the abbreviated ACRA questionnaire, which according to the result obtained are considered: Dimension I (Cognitive and control learning strategies) exploration, fragmentation, grouping, search for coding, search for clues, response planning, written response and self-awareness; Dimension II (support strategies) shared relationships, self-management, affective, social interactions and motivation; Dimension III (study habits) repetition and paraphrase. As shown in table II, the tactics with the highest average correspond to the students of the nursing faculty with a score of 3.38, the highest of all, for the motivational tactic, which in the case of university students and in the current context that is lived, is a very important factor that must be

taken into account to awaken the interest in learning, the way to do it and the achievement that it intends to achieve. It is followed by the 3.34 score that corresponds to the written response, that is, the students use writing, doing and applying and thirdly the exploration tactic with an average of 3.27, that is, the student reads before the topic to be discussed, what he considers important. Likewise, we find other tactics such as repetition, paraphrasing and grouping.

#### IV. DISCUSSION

The use of technology in communication oriented to learning processes has encouraged students to carry out team tasks collaboratively, without detriment to their academic performance, which is why it coincides with the statements mentioned by [4]-[7].

Likewise, motivational strategies in the learning of university students play a very important role during the development of academic activities, this makes the student predisposed to learn with enthusiasm, joy and reach the desired level of achievement. In relation to the results found in this research, the motivational tactic is the highest with an average 3.38 achieved by the students of the nursing faculty (Table II), this result coincides with that mentioned in the reference [13] that identified that among the most used strategies are those related to social and motivational support, it also considers planning and controlling tasks.

Likewise, having found that motivational strategies (support strategies), repetition and paraphrase (study habits) predominate in the research carried out, this agrees with the study carried out [12] who obtained the highest mean for study habits, which means that they use more understanding and study habits, it is followed by learning support strategies, where intrinsic motivation is used.

The research also agrees with the study [10] that by applying the abbreviated ACRA scale, it concludes that students use study habits strategies more, in support strategies they used intrinsic motivation, social support and less use of cognitive and learning strategies. learning control.

Likewise [11] also used the abbreviated ACRA for the collection of information, stating that the students used a significant number of strategies, such as repetition, rereading (acquisition) and social support (support); even when the frequency of use of rereading and repetition tactics has a high average, which could be understood as a "bad habit" since they do not favor the development of critical thinking.

It is possible to improve the performance of students if they are trained in the management of learning-oriented technologies so that they can apply them in their training processes and permanently, according to [21]. The flexibility of ways of learning with the support of technology is reinforced because the sample with which this work was carried out includes young people between the ages of 18 and 26, which is in agreement with what was stated by [24].

#### V. CONCLUSIONS

The research has made it possible to identify and analyze the learning strategies used by university students during the learning process enhanced by technology, in a Public

University of Peru, the result of which indicates that the major strategy used by the students of the Academic Areas of Sciences of Health and Social Sciences and Humanities is a habit of studies.

The student's academic performance is located in a very good grade, 61% of them have the vigesimal system grades of 17, 16 and 15. It is also followed by an excellent grade with 24% of students, this means that the learning strategies that they use in virtuality, has allowed them to obtain generally good grades. It is appreciated then, that the student assumes with understanding, reflection and responsibility how to learn in the current situation. Also, you should be concerned about the remaining percentage, which requires preparation of how to face the current situation of online learning.

Also given the current context and constant training in the use of technological tools, the teacher has improved his methodological strategies, compared to the first virtual semester, which has allowed the student to also adapt his study tactics, as can be seen in the table I and table II.

The results found allow us to recognize that the student is also the creator of his own learning strategy, this is related to the subjects and contents developed in educational practice, and has to do with the methodology used by the teacher, which is why it is recommended that the teacher has knowledge of the strategies used by the students and uses the resources and activities necessary to achieve learning.

Finally, the authors agree that students need to be guided to better develop their learning strategies in the current context in the face of the use of technological resources, especially when they have to carry out assignments and evaluations that are graded via the platform used by the university. Although the result indicates that students are motivated, predisposed to learn, it also depends a lot on the motivational strategies used by the teacher in synchronous or asynchronous educational practice; the same thing that the student learns to self-regulate his learning to achieve the desired achievement in relation to his learning.

#### CONFLICT OF INTERESTS

The authors declare no conflict of interest.

#### AUTHOR CONTRIBUTIONS

Maritza Arones: Conception and design of the article, writing and critical review of the article. He approved the final version of the article.

Olga M. Curro-Urbano: Conception and design of the article, writing and critical review of the article. He approved the final version of the article.

Carmen Luisa Chauca Saavedra: Conception and design of the article, writing and critical review of the article. He approved the final version of the article.

Ynés Phun-Pat: Conception and design of the article, collection and obtaining of results, critical review of the article. He approved the final version of the article.

#### REFERENCES

- [1] L. Y. G. Asencio, L. A. R. Jaramillo, and D. F. J. Macas, "El docente y la alfabetización digital en la educación del siglo XXI," *Sociedad & Tecnología*, vol. 4, no. S2, pp. 377-390, 2021.
- [2] E. C. Holguín and P. R. G. Sandoval, "Resistir la Covid-19. Intersecciones en la Educación de Ciudad Juárez, México," *Revista Internacional De Educación Para La Justicia Social*, vol. 9, no. 3, pp. 7-23, 2020.
- [3] G. González-Calvo, R. A. Barba-Martín, D. Bores-García, and V. Gallego-Lema, "Aprendiendo a ser docente sin estar en las aulas. la covid-19 como amenaza al desarrollo profesional del futuro profesorado," *International and Multidisciplinary Journal of Social Sciences*, vol. 2, no. 9, pp. 152-177, 2020.
- [4] M. O. T. A. Katihuska, C. Concha, and N. Muñoz, "Educación virtual como agente transformador de los procesos de aprendizaje," *Revista on line de Política e Gestão Educacional*, vol. 24, no. 3, pp. 1216-1225, 2020.
- [5] L. F. Aprile, "Educación superior y tecnología: Evolución histórica en la Argentina y el contexto social en tiempos de pandemia," *HOLOGRAMÁTICA-Facultad de Ciencias Sociales-UNLZ*, vol. VI, no. 32, pp. 163-180, 2020.
- [6] M. Hassan, "Online teaching challenges during COVID-19 pandemic," *International Journal of Information and Education Technology*, vol. 11, no. 1, 2021.
- [7] L. B. S. Troussel and M. S. Manrique, "La retroalimentación más allá de la evaluación," *Revista Latinoamericana de Educación Comparada: RELEC*, vol. 9, no. 14, pp. 89-104, 2019.
- [8] P. Espinoza, M. Paz, and C. C. Fernando, "Tecnologías avanzadas para afrontar el reto de la innovación educativa," *Revista Iberoamericana de Educación a Distancia*, vol. 24, no. 1, pp. 33-53, ISSN: 1138-2783, 2021.
- [9] H. Yaseen, A. Ratib, M. Nofal, O. Abdeljaber, and A. Al-Adwan, "The Effects of online learning on students' performance: A comparison between UK and Jordanian universities," *International Journal: Emerging Technologies in Teaching (iJET)*, vol. 16, no. 20, pp. 4-17, (2021).
- [10] P. Gamboa, "Evaluación de estrategias de aprendizaje y de percepción de la modalidad virtual en estudiantes de las carreras de la Facultad de Humanidades de la UMSS. Subversiones," *Revista de Investigación*, Edición año 5-N6, pp. 151-172, 2020.
- [11] C. Mercado-Elgueta, M. Illesca-Prety, and A. Hernandez-Diaz, "Relación entre estrategias de aprendizaje y rendimiento académico: estudiantes de enfermería," *Enferm*, vol. 16, no. 1, pp. 15-30, ISSN 2395 8421, 2019.
- [12] P. G. Afcha, "Evaluación de estrategias de aprendizaje y de percepción de la modalidad virtual en estudiantes de las carreras de la Facultad de Humanidades de la UMSS," *Rastros y rostros tras el barbijo*, no. 151, 2020.
- [13] J. C. Martínez-Royert and M. C. Pájaro-Martínez, "Relación entre los estilos y estrategias de aprendizaje en estudiantes de facultad de ingeniería de una Universidad en Colombia," *Revista Boletín Redipe*, vol. 9, no. 9, pp. 147-163, 2020.
- [14] M. Delgado and A. Solano, "Estrategias didácticas creativas en entornos virtuales para el aprendizaje," 2015.
- [15] M. S. A. Lancheros, "Motivación del aprendizaje en línea," *Panorama*, vol. 12, no. 22, p. 5, 2018.
- [16] V. G. Méndez, E. C. Magaña, M. R. Rodrigo, and R. Rodrigo, "Metodologías didácticas para el aprendizaje en línea," 2019.
- [17] A. Badia, L. C. Campos, J. V. D'Uniam, and G. S. D. Áz, "La percepción de la utilidad de la tecnología a conforma su uso para enseñar y aprender," *Revista electrónica de Investigación Educativa*, vol. 18, no. 3, pp. 95-105, 2016.
- [18] E. Vázquez-Can and M. L. Sevillano, "Dispositivos digitales móviles en Educación: El aprendizaje ubicuo," *Narcea Ediciones*, vol. 135, 2015.
- [19] P. H. C. Ayala *et al.*, "Disruptive innovation of educational digital tools and the achievement of communication skills in university students," presented at 2020 The 4th International Conference on Education and E-Learning, 2020.
- [20] M. S. Ramírez-Montoya, "Transformación digital e innovación educativa en Latinoamérica en el marco del COVID-19," *Campus Virtuales*, vol. 9, no. 2, pp. 123-139, 2020.
- [21] A. T. Akindele *et al.*, "Assessing learners' perceptions and experiences in distance education — A case study of LAUTECH Open and Distance Learning Centre (LODLC)," *International Journal of Information and Education Technology*, vol. 11, no. 10, 2021.
- [22] B. P. Alejo and A. F. Aparicio, "La planificación de estrategias de enseñanza en un entorno virtual de aprendizaje," *Revista Científica UISRAEL*, vol. 8, no. 1, pp. 59-76, 2021.
- [23] M. N. V. Vidal, "Estrategias didácticas para la virtualización del proceso enseñanza aprendizaje en tiempos de COVID-19," *Educación Médica Superior*, vol. 34, no. 3, 2020.

- [24] S. C. A. Pizarro and L. E. Past n, “Aportes desde las neurociencias para la comprensin de los procesos de aprendizaje en los contextos educativos,” *Propositos y Representaciones*, vol. 8, no. 1, p. e312, 2020.
- [25] J. F. Arias and F. J. Justicia, “ACRA-abbreviated learning strategies scale for university students,” *Electronic Journal of Research in Educational Psychology*, vol. 1, no. 2, pp. 139-158, 2003.

Copyright  2022 by the authors. This is an open access article distributed under the Creative Commons Attribution License which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited ([CC BY 4.0](https://creativecommons.org/licenses/by/4.0/)).



**Maritza Arones** graduated with a doctorate in education from the San Luis Gonzaga National University, Ica, Peru, 2009 and a second specialty degree in teaching methodology, 2016.

He is currently a principal professor of the Faculty of Education Sciences and Humanities of the San Luis Gonzaga National University and of the Graduate School of the same university. President of the central commission for curricular reform of the University and director of the academic program of Mathematics and Informatics at her workplace.

She has published scientific articles such as “Disruptive Innovation of Educational Digital Tools and the Achievement of Communication Skills in University Students” in 4<sup>th</sup> International Conference on Education and E-Learning, ICEEL 2020; Virtual, Online; Japan.

Dr. Arones is a member of the College of Teachers of Peru and the Network of Teachers of Latin America and the Caribbean (RedDoLac).



**Olga M. Curro-Urbano** was born in Lima on December 24, 1951, Dr. in public health UNFV (2007), master's degree: Adm Edu Superior UNSLG Peru 2005. She worked 20 years at ESSALUD (UCI, EMG). Research professor at the National University San Luis Gonzaga Peru from 1988 to the present at the Faculty of Nursing. Conducts research, forms research teams (seedbeds), advises undergraduate and graduate thesis.

It publishes scientific articles: Extreme violence against women and femicide: from the intimate scene to human trafficking in Peru. *Quad. Med. forensic* [online]. 2017, vol.23, n.1-2, pp.15-23. ISSN 1988-611X.

Disruptive education based on action characterizing eco-environmental variables to mitigate global warming, <https://doi.org/10.1016/j.procs.2020.05.142> Wants to continue researching and participating in scientific events.

Dra Curro-Urbano, is a member of the network of teachers of Latin America and the Caribbean (RedDolac).



**Carmen Luisa Chauca Saavedra** graduated with a doctorate in public health from the San Luis Gonzaga National University, Ica, Peru, 2011.

He is currently a principal professor at the Faculty of Dentistry of the San Luis Gonzaga National University, a specialist in Self-Assessment and University Accreditation. Peer External Evaluator in University Accreditation.

She has published the research Disruptive innovation in active activity-based learning methodologies through digital transformation in *International Journal of Information and Education Technology*, volume 11, Issue 4, 2021, Pages 200-204.

Dr. Chauca is a member of the Peruvian Society of Pediatric Dentistry.



**Yns Phun-Pat** was born in Lima, Peru, graduated with a doctorate in education from the San Luis Gonzaga National University, Ica, Peru, 2014.

He is currently a principal teacher at the Faculty of Biological Sciences of the same University; he is in charge of the zoology laboratory His area of interest is to continue with the educational field related to biological sciences: learning strategies, educational action-research, educational technology for online learning.

She has published the research Disruptive education based on action characterizing ecoenvironmental variables to mitigate global warming, 9th World Engineering Education Forum, WEEF 2019; Chennai; India. Volume 172, 2020, Pages 979-984

Dr. Phun; is a member of the College of Teachers of Peru and RedDoLac. He has participated in the university team that provided training and advice at the national level to secondary level teachers, in agreement with the Ministry of Education of Peru.