

# Self-perception on the Acquisition of Investigative Competencies in the Context of Virtual Learning during Covid-19

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**Abstract**—Research training promotes the development of students' research skills and competences. For this reason, the study focuses on analyzing the self-perception of the acquisition of research competences of mechanical and electrical engineering students at the National Technological University of Lima Sur, located in Peru. The purpose of determining these results is to generate a research culture in the university context, by means of policies, strategies and knowledge management mechanisms supported by the use of information and communication technologies (ICT). The research will be carried out in the year 2022, and from the methodological point of view it is descriptive and non-experimental design of transversal type. A questionnaire was designed for data collection, consisting of 12 indicators; the reliability of the data collected was assessed using Cronbach's alpha, whose value was 0.817. As there is no research training from the initial level of the curriculum plan that is aimed at enhancing the scientific and technological capabilities of the student, the results reveal that 72% failed to complete the development of scientific articles. With regard to the difficulties and/or weaknesses identified, they are centred on the low level of knowledge of quantitative or qualitative research, the concepts of techniques and instruments for data collection and discussion of results.

**Index Terms**—Investigative skills, Covid-19, self-perception of engineering students, virtual learning.

## I. INTRODUCTION

Higher education in the context of e-learning is marked by various challenges, many of which are linked to how to

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achieve the development of research competences in students [1], [2]. In this regard, technological tools in the context of health emergencies have proved to be very useful in the student learning process, as they have contributed to the development of competences linked to formative research [3], [4]. Formative research is relevant at university level as it allows students to develop a set of knowledge, skills and abilities to develop research processes [5], [6].

As indicated in [7]-[9], current higher education is marked by different challenges, many of which are oriented towards the development of academic competences related to scientific research. Research competences are not only useful for the optimal development of several of the activities proposed in classes, but also contribute to scientific production from the academy. In this sense, it is necessary for teachers to incorporate pedagogical strategies into their training plans that enable students to develop competences that provide future professionals with important knowledge and skills to access better employment opportunities [10]-[14].

However, developing learning processes in formative scientific research, in the context of social distancing or health crisis, is not easy, as it somewhat limits fieldwork and data collection [15]-[19]. It is therefore essential for university institutions to generate educational learning environments centred on virtual environments that facilitate the processes involved in formative research [20].

Bearing in mind that there are different ways of organizing the learning process that allow research competences to be developed, the use of technological tools has made it possible to implement these organizations within the context of virtuality [21], [22]. Thus, for example, in synchronous virtual learning sessions, it is possible to share criteria, reflect on the usefulness of procedures used in the search for information and the use of different research methods [23]. This is given, bearing in mind that research competences are closely linked to the ability to explore information from reliable sources, follow the scientific method in the inquiry process, communicate the results of their research, work in teams, thus achieving great educational achievements [24], [25].

This is why it is important to obtain information on the perception of research competences acquired by students [26]. In this respect, [27] state that identifying the perception makes it possible to influence certain factors in which the student has difficulties in achieving or developing research competences. On the other hand, in [28], [29], it is pointed

out that through self-perception it is possible to evaluate the domain of analysis and information processing and everything corresponding to the methodological domain.

Based on the above, this article aims to analyze the self-perception about the acquisition of investigative skills of students of mechanical and electrical engineering of the National Technological University of Lima Sur, located in the district of Villa el Salvador, province of Lima in Peru. The determination of these results aims to generate a research culture in the university context, through the implementation of policies, strategies and knowledge management mechanisms supported by the use of information and communication technologies (ICT). From the methodological point of view, a descriptive level research and a non-experimental cross-sectional design were proposed.

## II. LITERARY REVIEW

### A. *Formative Research in Pre-pandemic Scenarios*

On carrying out a search of bibliographical sources related to the subject of research, we see at first that it is not only a subject that is being analyzed in these times of health emergency, but that many studies have already been carried out on it. In this respect, [30] points out that the main problem in incorporating formative research is that universities do not have a sufficient number of teachers with research skills. This is because formative research requires university lecturers to adopt a different stance towards teaching and towards students. In the first position, the complex, dynamic and progressive nature of knowledge must be emphasized, and in the second, the potential of students must be recognized and accepted in order to take responsibility for being the protagonists of their own learning.

University educational organizations must plan for formative research in the curricula, as well as have the support of appropriately trained teachers, financial resources, infrastructure and equipment. This is where the research that is progressively undertaken as part of formative research takes on a major relevance. Through the thesis, it is one of the most effective ways of carrying out research in universities, as an alternative in the absence of financial resources and equipped laboratories [31].

Formative research is a teaching-learning strategy that introduces the subject of research into the planning of classes, and therefore leads to thinking before doing. The participation of the educational agents involved in a context being relevant, this implies that teachers, students and course contents must participate in the research, within an educational context [32].

### B. *Formative Research in the Context of Social Distancing*

Referring to the studies carried out in this context of the pandemic by Covid-19, [33] state that the health emergency and the social distancing generated by the pandemic have made us see that students can be motivated to do research, even in this context. This implies that in order to adapt students to this scenario, changes must be made to curricula

that lead to more time being devoted to teaching research tools and linking them as soon as possible to research groups, where they develop scientific thinking.

In [34], it is established that in this pandemic scenario, the orientation of the teacher in the formative processes of research requires not only mastery of the subject, but also a set of skills and competences, in which the appropriate use of communication technologies in educational practices is highlighted. The capacity to respond through initiatives undertaken by higher education is considered within the framework of a disruptive, unprecedented process, which managed to overcome trends estimated by multilateral organizations, in which social distancing threatened a total closure of university educational organizations. However, a transcendental transformation, of intervention and work between student-teacher-collaborators, has made it possible to achieve continuity in training and research, which is a significant advance in the transition driven from higher education and research towards digital technologies [35].

In this context of health emergency, studies and research on students' perceptions of the research practices considered in their university education are relevant. It is therefore important and necessary to evaluate them in order to understand the performance of university educational institutions in the development of formative research as a transversal element that serves to develop competences and capacities in research [36].

## III. METHODOLOGY

### A. *Level and Research Design*

The level of research is descriptive, because it seeks to identify, through frequency statistics, relevant aspects linked to the self-perception variable on the acquisition of investigative skills of students in the last cycles (7th to 10th) of mechanical engineering and electrical. As indicated by [37], descriptive studies are characterized by having a single study variable, this variable is called the variable of interest since the study focuses on this variable, also, due to the nature of the study. This study, being univariate, must take into consideration the factors or indicators found in its environment.

Regarding the establishment of the indicators that make up the self-perception variable on the acquisition of investigative skills, [37] point out that the number of characterization factors or indicators will depend on the expertise of the researcher based on their experience and they are empirical approaches; In this sense, in the present study, the variable under analysis is made up of twelve indicators, which can be seen in Table I.

The research design is non-experimental and cross-sectional, since the data was collected from the study sample without any action that could alter or modify the nature or initial state of the data. For this study, the evaluation of the self-perception of the acquisition of research competences of mechanical and electrical engineering students was carried out during the 2021-II academic semester.

**B. Methodology for the Analysis of the Variable**

The instrument used for data collection is a mixed questionnaire of 12 questions (Table I), the first 3 (I1-I3) with open-ended quantitative answers and the next 9 (I4-I12) with closed-ended answers. The results were processed in SPSS, using the 4-level Likert scale. To determine the validity of the data collected, the reliability test was carried out using Cronbach's alpha, using SPSS V25 software. The results show a high reliability value of 0.817. According to [38], Cronbach's alpha values between 0.70 and 0.90 indicate good internal consistency.

TABLE I: INSTRUMENT FOR DATA COLLECTION AND CODING OF INDICATORS

Codification	Indicators'
ID1	In how many subjects do you enroll in the academic semester 2021-II?
ID2	In how many subjects did the teacher leave the development of a scientific article as academic work?
ID3	In how many subjects in which the teacher requested to develop a scientific article, did you manage to fully develop the scientific article?
ID4	Do you agree that teachers associate the academic work of a subject with the preparation of a scientific article?
ID5	What was your level of knowledge regarding concepts related to quantitative or qualitative research?
ID6	What was your level of knowledge regarding specialized sources or databases in the search for bibliographical references?
ID7	What was your level of knowledge regarding concepts related to data collection techniques and instruments?
ID8	What was your level of knowledge regarding concepts related to the validity of data collection instruments and reliability?
ID9	What was your level of knowledge regarding concepts related to the processing and analysis of collected data?
ID10	What was your level of knowledge regarding concepts related to the discussion of results?
ID11	What was your level of knowledge regarding differentiating your own from that of other authors (citations)?
ID12	What was your level of knowledge regarding forms of referencing according to the APA standard?

**C. Preparation of a Scientific Article as a Training Activity in Research**

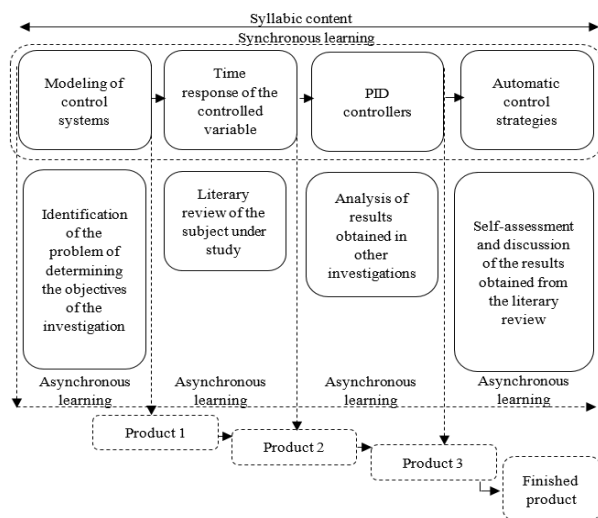


Fig. 1. Process architecture as part of the formative research process.

In different subjects of the last cycles of the professional

school of mechanical and electrical engineering, with the purpose of developing investigative competences in the students, the elaboration of a scientific article is being considered as part of the evaluation of the academic activity. This activity is carried out in a group on topics related to the subjects taught by the teacher, and the time they have is approximately twelve to fourteen weeks. Fig. 1 shows the architecture of the process in which it was used in the subject of automatic process control of the semester 2021-II.

**IV. RESULTS**

As part of analyzing the self-perception about the acquisition of investigative skills of mechanical and electrical engineering students, Fig. 2 shows the percentage relationship, with respect to the number of subjects enrolled in the academic semester 2021-II (ID1) and the number of subjects, where the teacher left the development of a scientific article as academic work (ID2).

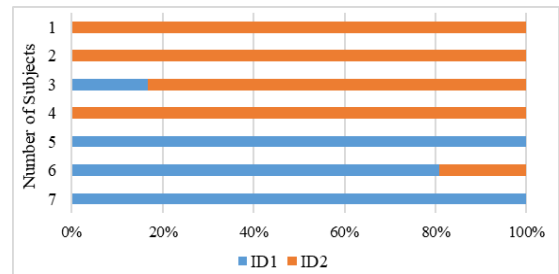


Fig. 2. Results of the ID1 and ID2 indicators.

From the results of Fig. 2, it can be interpreted that of the 68% of the students who enrolled in the academic semester 2021-II in 6 subjects, 16% of the students indicated that in the 6 subjects enrolled the teacher left as academic work the development of a scientific article. On the other hand, 28% of the students who enrolled in the academic semester 2021-II in 7 and 5 subjects, indicated that they were not allowed to develop a scientific article as part of the academic activities. While 4% of the students who enrolled in the academic semester 2021-II in 3 subjects, 20% of the students indicated that the development of a scientific article was left to them in the 3 subjects enrolled. In general, it can be seen that 100% of mechanical and electrical engineering students enrolled in the academic semester 2021-II, were given the development of a scientific article as part of the academic activities.

Next, in Fig. 3, the percentage relationship is shown, with respect to the number of subjects enrolled, in which the teacher left the development of a scientific article as academic work (ID2) and the percentage in which it was possible to develop them (ID3).

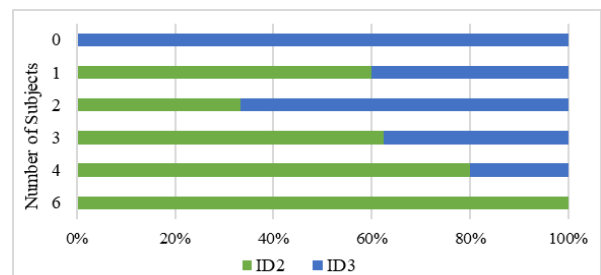


Fig. 3. Results of the ID2 and ID3 indicators.

From the results of Fig. 3, it is possible to determine the percentage of students who complied and did not comply with the development of the scientific articles that the teacher left them as academic work. According to Fig. 3, 72% of the students did not comply with the development of the scientific articles, being only 28% of students who did manage to develop them.

It should be noted that within the group of students who did not conclude with the development of the scientific articles, and responding to the ID4 indicator, 52% of students expressed their dissatisfaction (totally disagree and disagree) with their development and that this activity formed part of their qualification of the subject studied during virtual learning, specifically, of this group of students who expressed disagreement, 90.0% did not complete their development, as did 100.0% of students who expressed total disagreement. While 48% of students who stated that they totally agreed and agreed with the development of the scientific articles, only 45.5% managed to complete it and 54.5%, although they agreed with their development, did not manage to complete it.

Determined the percentage of students who complied and did not comply with the development of scientific articles, the factor will be analyzed regarding their level of knowledge (ID5-ID12), which allowed and/or hindered the development of scientific articles; this analysis was achieved using the cross-table test. Table II shows the levels of knowledge and indicators that allowed, according to the self-perception of the acquisition of research skills of the students, the fulfillment of the development of scientific articles.

TABLE II: LEVELS OF KNOWLEDGE AND INDICATORS THAT ALLOWED THE DEVELOPMENT OF SCIENTIFIC ARTICLES

Knowledge level	ID5	ID6	ID7	ID8	ID9	ID10	ID11	ID12
Good	28.6%	57.1%	71.4%	57.1%	28.6%	71.4%	42.9%	42.9%
Very Good	0%	0%	0%	0%	0%	0%	14.3%	42.9%

Table II shows that 85.8% of students who completed the development of scientific articles are those who indicated that they had an optimal level of knowledge (good and very good) with the indicators that refer to the concepts related to the ways of referencing according to APA standard (ID12), likewise 71.4% are those who indicated having a good level of knowledge regarding the concepts related to data collection techniques and instruments (ID7), in the same way 71.4% of students are those who They indicated that they had a good level of knowledge regarding the concepts related to the discussion of results (ID10).

TABLE III: LEVELS OF KNOWLEDGE AND INDICATORS THAT DIFFICULT THE DEVELOPMENT OF SCIENTIFIC ARTICLES

Knowledge level	ID5	ID6	ID7	ID8	ID9	ID10	ID11	ID12
Regular	55.6%	50.0%	55.6%	44.4%	50.0%	44.4%	33.3%	33.3%
Deficient	5.6%	5.6%	5.6%	22.3%	5.6%	16.7%	27.8%	11.1%

Table III shows the levels of knowledge and indicators that made it difficult according to the self-perception of the

acquisition of investigative skills of the students, the fulfillment of the development of scientific articles.

Table III shows that 66.7% of students who did not comply with the development of scientific articles are those who indicated that they did not have an optimal level of knowledge (regular and deficient) with the indicators that refer to the concepts related to the validity of data collection and reliability instruments (ID8), likewise 61.2% are those who indicated not having an optimal level of knowledge (regular and deficient) regarding the concepts related to quantitative or qualitative research (ID5), in the same way the 61.2% of students are those who indicated not having an optimal level of knowledge (regular and deficient) regarding the concepts related to data collection techniques and instruments (ID7), the same percentage of students are those who indicated not having an optimal level of knowledge (regular and poor) regarding the concepts related to the discussion of results (ID10), similarly 61.2% of students is are those who indicated not having an optimal level of knowledge (regular and deficient) regarding the concepts related to differentiating their own from that of other authors (citations) (ID11).

## V. DISCUSSION

The results showed that during the academic semester 2021-II, 72% of students did not comply with the development of scientific articles, within this group 90.0% disagreed with their completion and 100.0% of students strongly disagreed. Meanwhile, of the 48% of students who stated that they totally agreed and agreed with the development of the scientific articles, only 45.5% managed to complete them. This may be due to the lack of a research training process, which, as it is not developed progressively within the curriculum and is only developed in some subjects in the last cycles, does not allow students to strengthen their scientific and technological capacities, nor does it allow them to feel motivated to carry out these academic activities, which represent an enriching source of knowledge and skills. As indicated in [36], research practices that develop formative research are conditioned by the competences and capacities that students acquire from basic education, as well as by institutional factors that must ensure university education with adequate alignment towards a research culture.

The results obtained in [39] show that students who used formative research developed scientific, investigative and communicative skills according to the type of research carried out. In turn, [9] points out that one factor that prevents optimal research training is that the training of research competences does not form an integral part of the curricular plans of academic programmers, as in the case of engineering degrees, which is why the academic curricular profile needs to be redesigned. This may respond to the findings of [27] in which the students felt that the content worked on in these subjects has not helped them to consolidate the competence of bibliographic search or the use of APA regulations in their citations.

Regarding the students who did not comply with the development of scientific articles, 66.7% are those who indicated that they did not have an optimal level of

knowledge regarding the concepts related to the validity of data collection instruments and reliability of data; similarly in percentage, 61.2% indicated that their difficulty is related to concepts of quantitative or qualitative research, data collection techniques and instruments, discussion of results and differentiating their own from those of other authors (citations). In the same line of similarity, in the research carried out by [25] 74% of students showed a deficient level and 26% showed a regular level in the use of communicative and research skills, these difficulties are linked to the comprehension and production of texts, as well as in specific research skills: observing, describing, analyzing, synthesizing and interpreting.

According to the results and based on the authors cited, we highlight the relevance of formative research as part of the teaching-learning strategies at university level, as it allows the student to develop a set of knowledge, skills and abilities, as well as generating a more communicative link between the teacher and the students, especially in this context of virtualization. In this regard, [40] showed that the process of research training allows students to develop a greater culture and develop their competences more effectively, and that this training is currently closely related to the efficient use of technologies. Being even more relevant, [26] points out that there is a direct and significant relationship between the formative research variables and the achievement of competences in students.

Although it is true that at the beginning of this new teaching-learning modality, it may have been difficult to develop research competences in students, nowadays, information and communication technologies (ICT) have contributed to giving continuity to academic activities; however, the development of virtual work implies that teachers and students not only have a mastery of the subjects involved in research but also of the management of virtual platforms. For example, the many Google tools such as Google form, used to carry out online surveys, or software for data processing such as IBM SPSS online or other data processors that are managed from the cloud.

With regard to what was argued in the previous paragraph [41] point out that although the adaptation to virtual environments was a factor that influenced the continuity of formative processes in general, the change to virtuality could have benefits for research training, such as the development of competences for the efficient management of Information and Communication Technologies (ICT), Technologies for Empowerment and Participation (TEP) and Learning and Knowledge Technologies (TAC), and the development of professional competences. As pointed out in [34] in formative research tutorials in times of pandemic, it is emphasized that ICTs assist the development of constructivist pedagogical approaches because they provide an appropriate support for the realization of learning as interaction between those involved.

## VI. CONCLUSION

The results obtained led to the conclusion that the research training of the students does not go hand in hand with a training process from the initial level of the curricular plan

that is geared towards the enhancement of the student's scientific and technological capacities; for this reason, 72% of the students did not comply with the development of the scientific articles that the teacher left them as academic work. Likewise, the difficulties and/or weaknesses identified according to the self-perception of the students' acquisition of research competences are centred on the lack of knowledge of concepts related to the validity of data collection instruments and the reliability of data, quantitative or qualitative research, data collection techniques and instruments, the discussion of results and knowing how to differentiate between one's own work and that of other authors (citations). For this reason, the need arises to implement in the curriculum, contents and methods oriented towards the development of research training with emphasis on the technological field which is directly linked to professional engineering careers, taking into account the self-perceived weaknesses of the students, thus seeking to strengthen analytical skills, consolidating the training capabilities of students in this professional area.

## CONFLICT OF INTEREST

The authors declare no conflict of interest.

## AUTHOR CONTRIBUTIONS

Omar Chamorro-Atalaya formulated the problem as well as the research objectives and wrote the article as the main author. Carlos Gamarra-Bustillos was responsible for the writing under a holistic approach to the introduction. Victor Villanueva-Acosta developed the literary revision. Oscar Samanamud-Loyola carried out the research design as well as the data collection process. Antenor Leva-Apaza carried out the fieldwork and was involved in the data collection process. Abel Tasayco-Jala developed the processing and analysis of collected data. Almintor Torres-Quiroz was in charge of the interpretation of results as well as the discussion with the results of other investigations Gutember Peralta-Eugenio, carried out the review of styles and verification of the format established by the journal.

## REFERENCES

- [1] F. E. Ceballos, J. E. Rojas, L. G. Cuba, L. P. Medina, and A. R. Velazco, "Analysis of the quality of services in university centers," *University Science and Technology*, vol. 25, no. 108, pp. 23-29, 2021, doi: <https://doi.org/10.47460/uct.v25i108.427>.
- [2] B. Pastora and A. Fuentes, "Planning teaching strategies in a virtual learning environment," *Uisrael Scientific Journal*, vol. 8, no. 1, pp. 59-76, 2021, doi: <https://doi.org/10.35290/rcui.v8n1.2021.341>.
- [3] A. Ramos, M. Aldude, J. Estrada, V. Señas, and L. Andrade-Arenas, "Analysis of the use of technological tools in university higher education using the soft systems methodology," *International Journal of Advanced Computer Science and Applications*, vol. 11, no. 7, pp. 412-420, 2020, doi: <https://doi.org/10.14569/IJACSA.2020.0110754>.
- [4] N. E. López, S. R. Rossetti, I. S. Rojas, and M. A. Coronado, "Digital tools in times of covid-19: Perception of higher education teachers in Mexico," *Ibero-American Journal for Educational Research and Development*, vol. 12, no. 23, pp. 1-28, 2021, doi: <https://doi.org/10.23913/ride.v12i23.1108>.
- [5] A. N. V. Quevedo, A. N. García, and G. F. P. Cañizares, "Development of research competences during the Covid-19 pandemic," *Pedagogical Journal of the Cienfuegos University*, vol. 17, pp. 312-320, 2021.
- [6] N. M. García, N. K. Paca, B. B. Valdez, and I. I. Gómez, "Formative research in the development of communicative and investigative skills," *Journal of high Andean Research*, vol. 20, no. 1, pp. 125-136, 2018, doi: <https://dx.doi.org/10.18271/ria.2018.336>.

- [7] S. I. B. Hernández, N. Lay, H. Herrera, and M. Rodríguez, "Pedagogical strategies for learning and development of research skills in university students," *Journal of Social Sciences*, vol. 27, no. 2, pp. 242-255, 2021, doi: <https://doi.org/10.31876/rsc.v27i2.35911>.
- [8] J. Cabero, J. Barroso, A. Palacios, and C. Llorente, "Digital competence frameworks for university teachers: Its evaluation through the expert competence coefficient," *Interuniversity Electronic Journal of Training of the Faculty*, vol. 23, no. 2, pp. 1-18, 2019, doi: <https://doi.org/10.6018/reifop.413601>.
- [9] E. Atencio, "Investigative Competencies with emphasis on the technological field in university students," *Electronic Journal of Humanities, Education and Social Communication*, vol. 9, no. 18, pp. 143-161, 2015.
- [10] L. Ortiz, "Performance assessment as a strategic factor for university teacher academic performance," *Scientific Journal*, vol. 5, no. 15, pp. 336-349, 2020, doi: <http://dx.doi.org/10.29394/Scientific.issn.2542-2987.2020.5.15.17.336-349>.
- [11] J. Cabero, and A. Martínez, "ICT and the initial training of teachers. Models and digital skills," *Teachers, Journal of Curriculum and Teacher Training*, vol. 23, no. 3, pp. 247-268, 2020, doi: <https://doi.org/10.30827/teacher.v23i3.9421>.
- [12] J. E. Parra-Castillón, "Construction of investigative competence in engineering," *Journal of Engineering Education*, vol. 13, no. 25, pp. 12-19, 2018, doi: <https://dx.doi.org/10.26507/rei.v13n25.812>.
- [13] J. Rodríguez, "Soft skills as a basis for the good performance of the university teacher," *Innova Research Journal*, vol. 5, no. 2, pp. 186-199, 2020, doi: <https://doi.org/10.33890/innova.v5.n2.2020.1321>.
- [14] N. Aziz, H. Haryani, and H. Afdallyna, "ICT-supported for participatory engagement within e-learning community," *Indonesian Journal of Electrical Engineering and Computer Science*, vol. 20, no. 1, pp. 492-499, 2020, doi: <https://doi.org/10.11591/ijeecs.v20.i1.pp492-499>.
- [15] A. I. D. Rojas, M. J. A. Durango, and V. J. A. Rentería, "Formative research as a pedagogical strategy," *Pedagogical Studies*, vol. 46, no. 1, pp. 319-338, 2020, doi: <https://doi.org/10.4067/S0718-07052020000100319>.
- [16] A. Tua, "The need of a digital guide as a teaching strategy for the development of research competences," *Arje Journal*, vol. 15, no. 28, pp. 11-28, 2021.
- [17] D. Ocampo-Eyzaguirre, W. Sucari, J. Anaya, R. Medina, and H. Zuñiga-Sánchez, "Disruptive education: New challenges in the training of social researchers in pandemic and social distancing contexts," *Research Journal University Notes*, vol. 12, no. 1, pp. 75-91, 2022, doi: <https://dx.doi.org/10.17162/au.v11i5.916>.
- [18] C. Coman, L. G. Țiru, L. Meseșan-Schmitz, C. Stanciu, and M. C. Bularca, "Online teaching and learning in higher education during the coronavirus pandemic: Students' perspective," *Sustainability*, vol. 12, no. 24, pp. 1-22, 2020, doi: <https://dx.doi.org/10.3390/su122410367>.
- [19] S. Ouahabi, K. El Guemmat, M. Azouazi, and S. El Filali, "A survey of distance learning in Morocco during Covid-19," *Indonesian Journal of Electrical Engineering and Computer Science*, vol. 22, no. 2, pp. 1087-1095, 2020, <http://doi.org/10.11591/ijeecs.v22.i2.pp1087-1095>.
- [20] M. R. Velásquez, A. M. Arnat, C. M. E. Velastegui, and L. R. Domínguez, "Trans-Covid formative research: Transcendence in virtual Education in Uniandes," *Pedagogical Journal of the Cienfuegos University*, vol. 17, pp. 146-152, 2021.
- [21] M. E. F. Loayza, "The signing of research as a strategy for the formation of investigative competences," *Scientific Journal of the Faculties of Humanities*, vol. 9, no. 1, pp. 67-77, 2021, <https://dx.doi.org/10.35383/educare.v9i1.594>.
- [22] I. A. Hieder, S. M. Abdullah, and R. A. Ali, "Utilizing the ATM technology in e-distance learning," *Indonesian Journal of Electrical Engineering and Computer Science*, vol. 20, no. 2, pp. 1016-1029, 2020, doi: <https://dx.doi.org/10.11591/ijeecs.v20.i2.pp1016-1029>.
- [23] A. Rosario-Rodríguez, J. Gonzales-Rivera, A. Cruz-Santos, and L. Rodríguez-Ríos, "Technological, academic and psychological demands in University Students during the Covid-19 pandemic," *Caribbean Journal of Psychology*, vol. 4, no. 2, pp. 176-185, 2020, doi: <https://dx.doi.org/10.37226/rcp.v4i2.4915>.
- [24] D. Vlachopoulos, "Quality teaching in online higher education: the perspectives of 250 online tutors on technology and pedagogy," *International Journal of Emerging Technologies in Learning*, vol. 16, no. 6, pp. 40-56, 2021, doi: <https://doi.org/10.3991/ijet.v16i06.20173>.
- [25] A. N. García, G. F. P. Cañizares, and A. N. Quevedo, "Evaluation on the formation of research competences and the use of research method with law students," *Pedagogical Journal of the Cienfuegos University*, vol. 17, pp. 65-72, 2021.
- [26] N. Pauca, M. N. Alfaro, J. O. Garc á, J. R. Quiroz, and J. Rafayle, "Formative research and achievement of competences in students of a public university — Lima," *Puriq Journal of Scientific Research*, vol. 3, no. 2, pp. 365-384, 2021.
- [27] M. J. Rubio, M. Torrado, C. Quirós, and R. Valls, "Self-perception of investigative competences in final-year students of pedagogy of the University of Barcelona to develop the final grade work," *Complutense Journal of Education*, vol. 29, no. 2, pp. 335-354, 2016, doi: <https://dx.doi.org/10.5209/RCED.52443>.
- [28] C. G. A. Quezada, A. M. P. Castro, N. J. M. Oliva, and C. M. P. Quezada, "University teacher's work self-perception: Identifying applicable research competences in 2020," *REDIPE Newsletter Journal*, vol. 9, no. 1, pp. 164-173, 2020, doi: <https://doi.org/10.36260/rbr.v9i1.905>.
- [29] M. J. Ru é-Rec ándiz, V. Jiménez-Arroyo, M. I. Huerta-Baltazar, L. A. Alcántar-Zavala, J. M. Herrera-Paredes, A. R. and Picazo, "Self-perception in research competences in University nursing Students," *REDIE Investigative Praxis*, vol. 12, no. 23, pp. 117-131, 2020.
- [30] J. Miyahira, "Formative research and research training at the undergraduate level," *Hereditaria Medical Journal*, vol. 20, no. 3, pp. 119-122, 2019.
- [31] C. V. Alvitres, L. A. Chambergo, and C. J. Fupuy, "Formative research and Peruvian university accreditation," *Journal of Scientific Research*, vol. 11, no. 2, pp. 37-48, 2014.
- [32] B. O. Díaz, B. M. Montes, and S. O. Cangahuala, "Research training at the undergraduate level: a proposal based on the accounting sciences school's curriculum at PUCP," *Hermes Scientific Journal*, vol. 19, pp. 409-431, 2017.
- [33] S. González-Garc á, P. I. Casadelvalle, M. O. Urda-Bordoy, D. A. Yedra, S. T. Fortum, and D. P. N. Mezquia, "Covid-19 and medical students' scientific training," *Cuban Journal of Biomedical Research*, vol. 40, no. 1, pp. 1-14, 2021.
- [34] B. M. Rojas, S. J. L. Pérez, and B. C. Y. Rayo, "Formative research tutorials in times of pandemic: Challenges and necessary transformations," *Philosophy Journal*, vol. 38, pp. 239-251, 2021, doi: <https://doi.org/10.5281/zenodo.5146797>.
- [35] A. J. Paredes-Chac ún, A. Inciarte, and D. Walles-Peñaloza, "Higher education and research in Latin America: Transition to the use of digital technologies by Covid-19," *Journal of Social Sciences*, vol. 26, no. 3, pp. 98-117, 2020.
- [36] E. Martínez-Huamán, M. A. Bellido, R. Villar-Cortez, G. R. Plata, and E. Félix-Benites, "Formative research and research practices in university education from the student's perception," presented at the International Conference on Research in Education (CIINED), doi: <https://doi.org/10.34893/wz2t-wa64>.
- [37] J. Ochoa-Pachas, and Y. Yunkor-Romero, "The descriptive study in scientific research," *Peruvian Legal Act*, vol. 2, no. 2, pp. 1-19, 2020.
- [38] H. C. Oviedo, and A. Campo-Arias, "Approach to the use of the alpha coefficient by Cronbach," *Colombian Journal of Psychiatry*, vol. 34, no. 4, pp. 572-580, 2005.
- [39] A. Ruiz, "Scientific research skills through formative research in secondary education students," *UCV-HACER Journal of Research and Culture*, vol. 3, no. 1, pp. 16-30, 2014.
- [40] J. J. Reyes, M. P. Cárdenas, and T. C. Gavilánez, "Development of research competences measured by technologies in students of the career of agronomy," *Conrado Journal*, vol. 16, no. 73, pp. 108-113, 2020.
- [41] O. P. X. Mejía, and L. P. A. Velásquez, "Changes to social work training and research practices generated by covid-19: Opportunities, dilemmas and challenges for social research," *Alternatives: Social Work Notebooks*, vol. 28, no. 2, pp. 325-349, 2021, doi: <https://doi.org/10.14198/ALTERN2021.28.2.08>.

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