Proposal of a Model for the Development of University Teacher Training Through Virtual Courses

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Abstract—During the COVID-19 pandemic, the education sector worldwide was affected. To minimize the problem, they put in place strategies to get virtual classrooms off to an optimal start. Also, teachers had to be trained, to be up to date with the context. Training must be asynchronous. In this sense, the objective of the research was to set up a model of teacher training through virtual courses. These courses consist of the teaching and learning strategy, teaching resources and materials, learning assessment system, curriculum planning and teacher induction. Virtual course prototypes have been completed for future implementation. The proposed model will provide those involved with a tool that optimizes the teaching and learning process. The methodology used in this research consisted, first, in analyzing the current situation and the proposal to be considered, and then in validating the model with experts in educational pedagogy and others in technological education. Likewise, a 10-question instrument was developed for expert validation of the proposed model, which resulted in an acceptance rate of 85.5%.

Keywords—curricular planning, educational model, investigation, teacher training, technological resources

1 Introduction

Currently, the use of technological resources has grown exponentially worldwide due to the pandemic in different sectors such as health, business, education, etc. [1]. In the education sector, countries around the world have proposed their guidelines and policies for dealing with the pandemic [2]. This has led universities, departments of education, to propose strategies to address this identified risk.

Peruvian universities offer distance learning courses. The university law 30220 establishes it as a modality to carry out courses in times of pandemic. But they also offer alternatives of mixed classes and face-to-face classes, which can have a maximum of 20% of credits in virtuality. In this sense, the universities must restructure their curricular plan to place their virtual courses, according to the modality to be offered.

Faced with the problem of the pandemic, the University of Sciences and Humanities of Lima (Peru) is implementing strategies to deliver its courses at a distance. One of the

problems encountered is that most teachers are not trained in the use of digital tools [3]. Faced with these problems, the University began to carry out training to improve and develop the digital skills of teachers [4]. Thus, they had to be trained in the use of digital tools to conduct their class sessions, such as digital whiteboards, mind maps, collaborative tools, among others, as well as in the use of the educational platform Moodle to interact with students on assignments, video forums, uploading of resources and teaching materials...

In addition, to ensure communication between teachers and students in the classroom, a video conferencing platform was needed. At the time, the most used for their security were Google Meet and Zoom [5]. The university began conducting business with Zoom with a time limit of 40 minutes. This difficulty was ameliorated by the acquisition of Zoom videoconferencing at the university on an unlimited basis for each teacher. In addition, teachers had to be trained on all the benefits of videoconferencing, as it is a tool that interacts directly with students. In addition, teachers had to be trained on all the benefits of videoconferencing, as it is a tool that interacts directly with students.

The problem is not only digital skills [6], but also the distance learning strategy. The same applies to the evaluation of students and the use of didactic material. In this sense, it was necessary to take into account that pedagogy in the face-to-face modality is different from virtuality [7]. Therefore, initially, it was necessary to select teachers who have at least the digital competency profile and who have implemented their teaching and learning strategy by competency.

Faced with this problem, it is proposed to make a proposal for teacher training, through a model that then allows its implementation, with the creation of virtual courses in an asynchronous way [8]. All these virtual courses will have a structure of forums, tasks, videos, questionnaires and webinars. The model will then allow for implementation, execution and startup.

The work proposed here is relevant because it will allow its teachers to contribute to the development of their abilities and skills [9]. In addition, the university can have virtual courses on topics that allow the development of teacher training and in this way, the students will benefit. The contribution of the article is through its proposal model, where the studied university will benefit, since teachers and students will have an alternative to improve the teaching-learning process.

Faced with the problematic exposed, the following question arises: how to improve the digital, pedagogical and investigative skills of teachers?

The objective of the research is to propose a model for the development of teacher training with virtual courses in an asynchronous way, so that teachers can develop their digital, pedagogical and research skills.

The article is structured as follows. Section 2 presents the literature review. The methodological aspects are described in section 3. Section 4 discusses the main results obtained. Finally, section 5 gives the mains conclusions and future work.

2 Literature review

Teacher training allows students to have teachers who are developed in their pedagogical and investigative skills. Thus, teachers trained in the competency-based teaching and learning process can demonstrate all of this knowledge to their students. Online classes require teachers to be able to assess their students and manage teaching and learning strategies in this virtual mode [10].

Most of the teachers who were trained have improved their digital skills. The satisfaction could be verified, thanks to the survey that was carried out; the result was that 58.82% of the satisfaction that the teachers have developed their digital skills in virtuality, through a good strategy and didactic in teaching and in the use of resources, as well as evaluation with their students [11].

Similarly, in the research work[12], the focus is on the implementation of competency-based teaching, for which teachers were trained to impart the use of information and communication technologies (ICT) to their students. The contribution of the research is that the students trained the teachers to be able to demonstrate their cognitive abilities in the teaching-learning process, either virtually or in person.

Also, the author of [13], establishes that the use of didactic resources and materials is important, where teachers must be trained and know how to use it virtually, resulting in satisfaction from the administration, for the progress in the use of ICT and knowing how to use it, as well as uploading pedagogical materials and resources.

Besides, research conducted by [14], there was training of teachers in the integration of teaching with the use of technological resources and platforms such as Moodle and Zoom. This achievement is that the use of ICT is complemented with the teaching-learning process and that resulted in having teachers with digital skills.

The author of [15] establishes that digital competence is multidimensional, which increases the level of complexity of the evaluation process. For this reason, it must be planned and evaluated systematically through the design of validated evaluation instruments. The designed instrument was applied to teachers and students, and consists of 88 questions. The test was divided into 4 dimensions: didactic aspects, planning and management of technological resources and spaces, relational aspects, and personal and professional aspects. Once the instrument was applied, the reproducibility of the instrument was evaluated using Cohen's Kappa coefficient and its reliability with Livingston's coefficient. The values obtained in the Kappa coefficient ranged between 0.6 and 0.8, which is considered acceptable. It was possible to establish a cut-off point for conducting the pilot study. Finally, it is concluded that to evaluate the dimensions of digital competence, it is possible to apply an objective multiple-choice test since it offers better statistical and reliability results. However, it is necessary to ensure consistency between what is evaluated and the procedure applied.

In this situation of virtuality, in the teaching-learning process, it is necessary for its actors to have the necessary management of technological tools [16]. Here the teacher plays an important role, who must have the necessary digital skills to be able to guide and accompany their students. In this research, an analysis is made of the digital competences of teachers from various Spanish universities, when using mobile devices, with which they can experience innovative educational processes. A sample of 155

teachers, was obtained, three work groups were set up and collected perceptions of the experiences and the most relevant competences, that they were putting into practice. Interesting results, were obtained, that see the importance of commitment and involvement in the project in order to have innovative results and a central aspect, is good communication and making the most of the ability to have access to information.

The different productive organizations, require that their main actors have the management, domain and ability in Information Technologies, this commits higher educational institutions to prepare and develop digital skills in future professionals. Addressing this problem also includes preparing their teachers [17]. In Europe, to propose the necessary policies and strategies, it implies making a diagnosis of it, in such a way as to really understand what happens with teaching and learning. For a group of 200 students and 381 teachers, studies indicate that there are limitations in the use of digital tools. Teachers in their developed distance education establish the importance in planning, and 44% of these indicate that the level of prior preparation has been satisfactory, while 36% state that the level of preparation was regular [18]. Another relevant element is ICT training. Of the 56% of teachers who carried out this activity, 49% show the great usefulness of these skills at the time of their class sessions. The teachers of vital importance collaborative work, among their peers and the accompaniment in the acquisition of technological skills.

Digital competence in teachers must be strengthened, so that they are not dependent on a program or an educational app, since these applications either evolve or vary in version, in such a way that they are prepared for constant change [19] . It is not enough for the teacher to have developed technological competencies [20] , but rather they must adapt to the moment and the situation, and make this competence useful in pedagogical practice and internalize it in their professional practice.

In summary, the authors agree that they need to develop their digital and pedagogical skills; however, the teaching and didactic strategy needs to be strengthened, as they carry out the teaching-learning process of virtuality without knowing how to differentiate it from face-to-face learning. This leads to the training of this modality, and it is concluded that these trainings can be realized with virtual courses in an asynchronous way.

3 Materials and methods

The research has a qualitative and quantitative approach, with a descriptive scope.

On the qualitative side, interviews were conducted with all the people involved, who shared their perceptions.

On the quantitative side, an evaluation of the proposed model was conducted by experts. The population consisted of 25 students from Administration 80 who were interviewed for information. The sample was purposive: 6 administrative and 35 students.

3.1 Analysis

Systemic approach. This approach is based on holism [9]. The interrelation of all its elements as a whole, forming a system. It also analyzes the interrelation of its parts, because concatenated, they communicate to form the whole, which is what emerges after its analysis.

In this sense, the people involved in the survey were analyzed, namely: University Professor, Head of Academic Department, Director of Research, Head of Quality Area, College Student, Academic Director and Professional Program Director.

In Figure 1, we observe through a pictorial chart the people involved and their concatenation, as well as the elements external to the system that influence the object of study of the research.

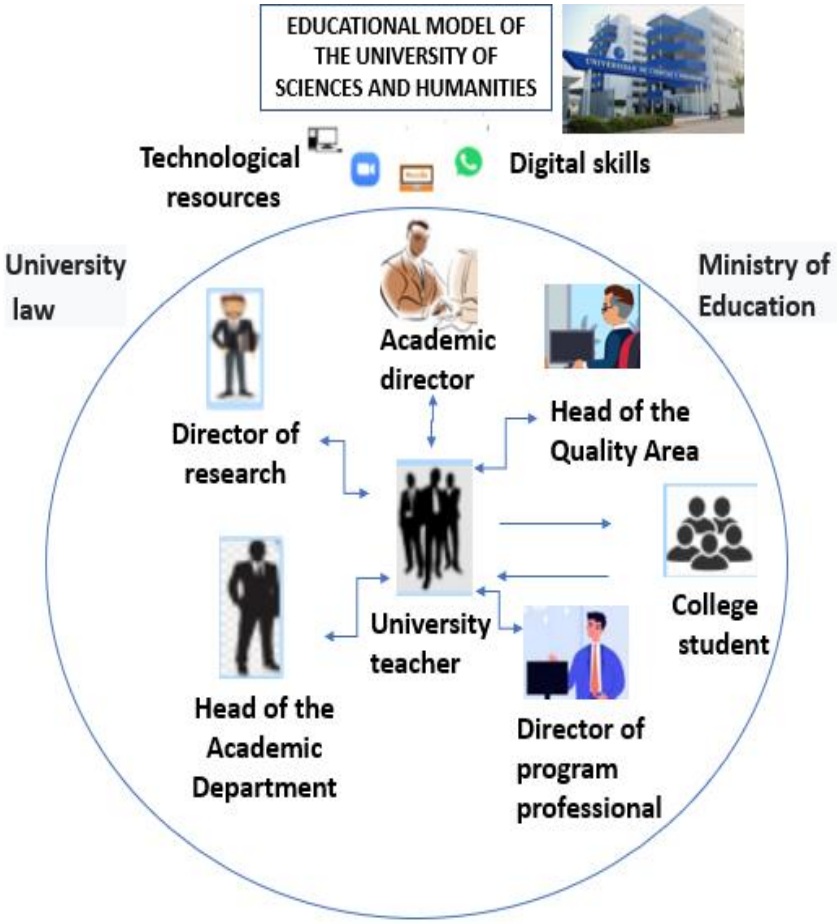

Fig. 1. Proposed approach as an holistic view

Stakeholder interviews. A semi-structured interview was conducted with open questions to the aforementioned stakeholders, focusing on teacher training. Two questions were asked as a guide to collect information. The questions were:

1. What is your opinion about teacher training today?
2. How would you like to see teacher training in the future?

This made it possible to systematize the responses of the interviewees in Table 1. In this table, there is the current situation, which is from the first question of the interview and the desired situation, from the second question. With transformation analysis the gap is shortened.

Table 1 shows the current status of the interview of all individuals involved, where the responses are analyzed, highlighting the category of analysis in Table 2. The category of analysis, was carried out by systematizing common points, of all the responses of the participants. interviewed. In Table 2, in the second column, the emerging category has been placed, which allowed making a design based on these 4 categories.

Table 1. Current status of the interview of all individuals involved

Perception	Current situation	Desired situation
University teacher	Teachers with a lack of training in technological resources, and to improve they have to be trained more frequently	Teachers trained in virtual teaching strategy, and the use of digital tools for their class session
Head of the Academic Department	The professors dictate without differentiating teaching from face-to-face and virtually	Teachers who develop appropriate teaching strategies for the virtual environment
Director of research	There are still limitations in research skills in most teachers, so they can later publish articles in indexed journals and radiate with their students	Research teachers and research work with students. They are part of research groups and participate in research projects
Head of the Quality Area	Traditional strategies and techniques centered on the teacher are applied, normally applied in teaching by objectives	Appropriate strategies and techniques in the student for the teaching of competences
College student	Teachers have no experience using digital tools. Lack of didactics in teaching students	Teachers are proficient in the use of digital tools to improve teaching
Academic director	The teacher has limits to interact with the students and also to evaluate. He uses the same methodology in presence as in virtual	He uses the diversity that technology offers for the purpose of each course. He knows how to differentiate and apply different methodologies for face-to-face and virtual courses
Director of program professional.	Part-time teachers are not trained in competencies. There is no teacher induction and show the educational model	Teaching profile according to the educational model and teaching induction

Table 2. Analysis of the responses of the actors listed in Table 1 and categorization

Classified popup elements	Emerging categories	Priority
Zoom, Google Meet, jamboard, digital whiteboards	Technological resources	High
Elaboration of syllabus, class session	Curriculum planning	High
Didactics, strategy, methodology, pedagogy	Processes didactic pedagogists	High
Search for information, references	Teaching research	High

The following activities were carried out to transform the current situation into the desired situation.

— ***University Teacher***
1. Make a plan of the asynchronous virtual courses.
2. Train teachers in the use of digital tools.
3. Train teachers in teaching strategy.
4. Train teachers in investigative skills.

— ***Head of the Academic Department***
1. Get training in teaching strategy.
2. Train in teaching didactics.
3. Get training in the competency assessment system.
4. Be trained in the use of technological resources.

— ***Director of Research***
1. Training in scientific writing for high impact indexed journals.
2. Organize research groups in the different faculties.
3. Coordinate the participation of teachers in investigative events.
4. Training of teachers in the formulation and management of research projects.

— ***Head of the Quality Area***
1. Update the pedagogical model.
2. Update the didactic model.
3. Update the evaluation system.
4. Update the teaching profile.

— ***College Student***
1. Train teachers in how to teach.
2. Carry out activities with teachers in the use of ICT in education.
3. Train teachers in ways to evaluate.
4. Train teachers in the use of Moodle and Zoom.

— ***Academic director***
1. Train in virtual tools.
2. Train in the logic of virtuality.
3. Train in tools and materials around virtuality.
4. Evaluate the use of interactive digital tools and preparation of materials.

— ***Professional Program Director***
1. Train teachers by competencies.
2. Do induction with new teachers.
3. Improve the use of digital tools as a medium.
4. Do asynchronous virtual courses.

3.2 Design

The pop-up category templates shown in Table 2 were created.

Technological resources. Figure 2 shows the different technology resources the teacher will be trained on the Moodle platform [21]. In addition, these technology resources, such as Moodle educational platforms, will be trained at different levels, from basic to advanced. Similarly, digital tools, such as collaborative tools, including jamboard, content curator, such as pocket, will allow the teacher to have an instant repository. Similarly, assessment tools such as quizzes allow students to be evaluated at the end of the course. Visual organizers, such as mind maps, give them a more organized idea to apply in their lessons. Similarly, content repositories such as google drive allow students to share assignments, tasks, and more online. Finally, video conferencing such as Zoom, is what teachers will use in their courses, so they can interact with their students, and do group work and such [8]. They will be trained from basic to advanced level.

The use of technological resources constitutes a support that serves as a complement to the teacher and the student in the teaching and learning process. The importance of the use of technological tools is that it optimizes the processes of information search, simplifying the steps directly in the processes in general.

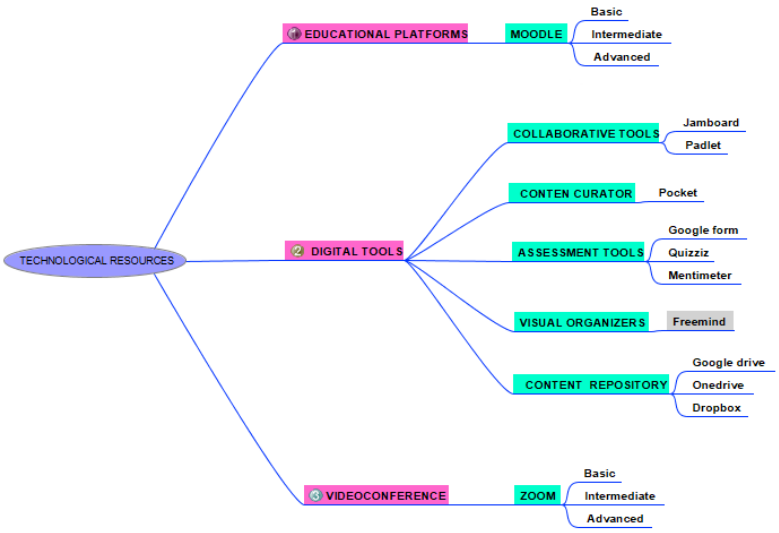

Fig. 2. Technological resources

Curriculum planning. Figure 3 considers three dimensions, where the first is the instructional management instrument in which the teacher must be trained to know how to develop instruments, rubrics by competency.

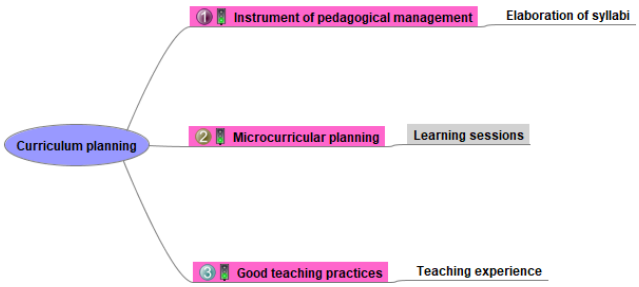

Fig. 3. Curriculum planning

The second dimension is microcurricular planning, through the learning sessions, where the teacher will know how to plan his lesson plan at different moments, that is, at the beginning, during and at the end of the class. The last dimension is that of good teaching practices, where the teaching experience is socialized in the classrooms and recorded so that teachers can visualize and share their experiences, for continuous improvement through discussion.

Likewise, good teaching practices can be achieved with meetings, where teachers intervene to say that it has been done well and that it is necessary to improve. That is, to make a continuous improvement so that the class sessions are better.

Didactic pedagogical processes. Figure 4 shows the dimension of didactic pedagogical processes. The technique and strategy of teaching in class, allows the teacher to develop in his classes, different methodologies and didactics, through techniques, which allow his class session to be dynamic [22]. Likewise, the resources and teaching materials allow the teacher to know how to use and download the material to share it with his students, as well as to synthesize the ppt, pdf files among other students, to get the information in an efficient way. The last dimension, is the assessment of learning, where the teacher will learn the strategy to be able to assess, as well as develop a rubric and its use. The teacher must be able to know how to develop instruments, for a class session or otherwise. In addition, he/she must show his/her students the assessment rubric he/she has prepared, with the criteria he/she has in constructing the rubrics. In this sense, teachers need to be well trained, not only to know how to prepare instruments, but also to know how to design a good rubric, weighting the questions to be assessed.

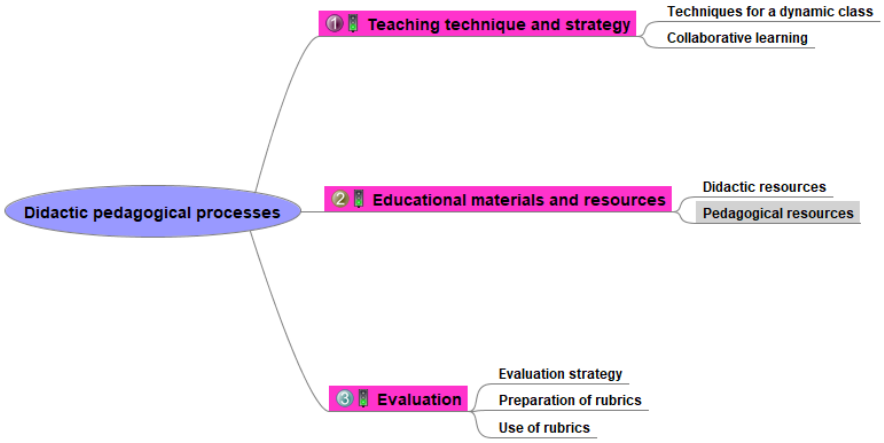

Fig. 4. Didactic pedagogical processes

Teaching and research. As shown in Figure 5, we can observe that the educational research has 3 sub-dimensions. The first one, information retrieval, allows you to become familiar with different search methods, especially in the Scopus database. In this way, you can teach your students to develop their investigative skills [23]. On the other hand, in the use of bibliographic managers, the teacher must be trained to know how to use the Mende-ley software, as well as to make citations and references, in a more automated way. Likewise, the teacher must be prepared to write articles, as well as to know the structure of an article, to correct an article as the research progresses, and also to use anti-plagiarism software, of which the best known is Turnitin. These dimensions analyzed, allow the teacher to develop his or her digital, investigative, and pedagogical skills, and thus his or her teacher training.

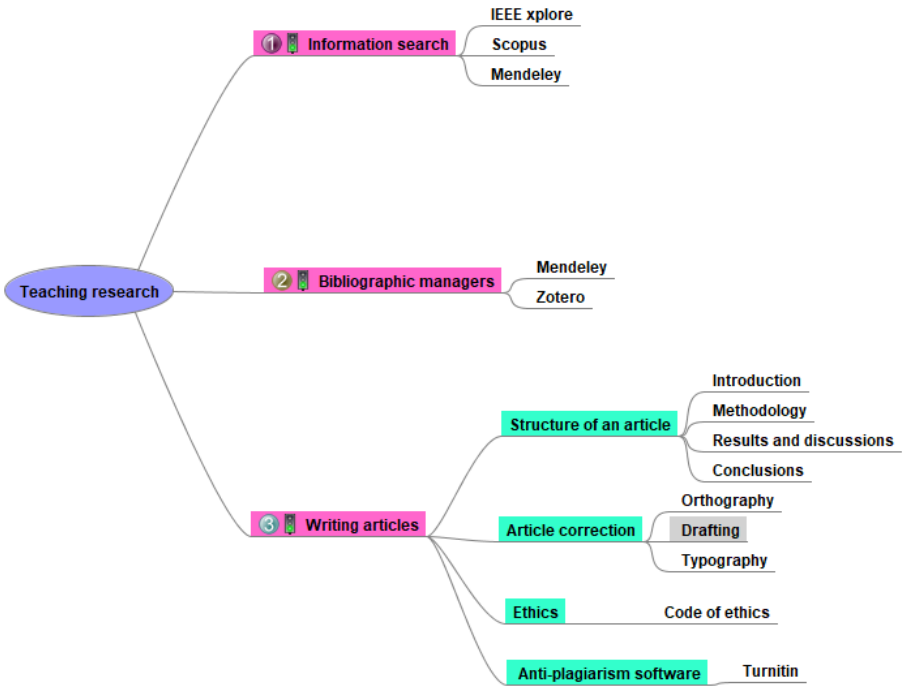

Fig. 5. Teaching and research

4 Main results and discussion

4.1 Qualitative analysis of data by category

Technological resources. To carry out the analysis, it was done with the participation of experts in the technological and didactic fields, where they observed that there were many activities in the presented Figure 2; that is, a heap of knowledge in the model. This made it possible to remove some of them.

In addition, the Moodle platform is currently used in the university, where teachers are increasingly incorporated and most know the basic part and do not deepen its use knowing all its advantages. An experience in the article [24], its teachers have advanced to an advanced level using Moodle but for this they have worked with the support of the administration. The research studied will be funded for implementation in its second phase. Similarly, Zoom video conferencing is being used by faculty and students, but at a basic level. It is proposed to train at an advanced level by knowing all its parts and mastering it. The authors [25], [26] agree that the use of Zoom videoconferencing and Moodle, it is very important that their teachers know it in depth and have obtained it, through constant training. Coinciding with the authors, the research also raises the training, but asynchronous, where the teacher you can enter the training at any time, anywhere.

Curriculum planning. In this dimension, as shown in Figure 3, all its elements that make it up are preserved, but it is suggested that for the gradual construction that is going to be carried out, other elements can be added such as summary, learning evaluation. In [27], establishes that curricular planning is important to analyze based on its educational model, one of its elements is evaluation, which converges with the ideas of the research model since it also proposes this element in its gradual construction.

Didactic pedagogical process. In this dimension, correction of pedagogical terminologies, was made, as well as some activities were increased, which is shown in Figure 4. The teaching technique and strategy can be carried out with flipped classes, as well as applying problem-based learning [28], [29]. Also, the different teaching-learning methods, techniques, procedures and strategy can be gradually added.

Teaching and research. Some activities, were removed as it was noted that there were many options. In Figure 5, this dimension is shown where modification was made in the article writing subdimension. According to the authors [30] **,** they establish, that it is very important that teachers know, how to write their research in the correct way. But they should also know how to identify indexed journals, their searches for information and know how to differentiate from journals that are predatory. On the other hand, in study research, it focuses more on the fact that the teacher must first be trained with investigative tutors, experts in the field, so that they can guide them in the correct way of searching for information and writing.

Confirmed and validated activities. The following thirteen activities were confirmed and validated:

1. Teacher training in the use of tools.
2. Training in teaching strategy.
3. Training in the elaboration of syllabus.
4. Training in the use of Moodle.
5. Training in the elaboration of rubrics.
6. Information search training.
7. Training in the educational model of the university.
8. Video conferencing training.
9. Training in educational platforms.
10. Visual organizer training (Removed).
11. Training in research.
12. Training in methodological strategy.
13. Teaching induction (inserted).

The activity that has been removed is that of the visual organizers, because at the moment it does not have importance. Addition of the induction of teaching, which due to its importance, happened to make a module in the proposal of the model. In total, the proposed activities were 28. The activities were confirmed and validated, leaving 12 activities. They were analyzed taking into account criteria such as the grouping of related activities, as well as the elimination of those that do not add value and the insertion of those that may emerge. Then they were analyzed to see how many do not add value and are eliminated. In this case, one activity was eliminated, namely the training of visual organizers; the remaining 11 activities and finally, the activities that emerge and

must be inserted into the project. The insertion of an activity, which comes to make the induc-tion of teachers, leaving the 12 selected.

4.2 About the prototype design

The following prototypes made in Balsamiq, allow to have an overview of the modeling, when it will be implemented.

Figure 6 shows the web page and its first welcome contact. In addition, Figure 7 shows the user's registration, entering their respective data. Then, the user logs in by entering his username and password, as shown in Figure 8, after having previously registered. In the prototype shown in Figure 9, you will find all the modules, so that the teacher can choose. The first option is the mandatory initiation. In Figure 10, we observe the design of the technological resources module, which has 3 topics for the teacher's training, which will allow him/her to develop his/her digital skills by appropriately using all the digital tools presented in this module. Similarly, Figure 11 shows the design of the Moodle platform, which is accessed through the educational platform option in Figure 10, entering, it is necessary to create tasks, a discussion forum between registered teachers. The teacher has materials and videos, a webinar to reinforce what they learn.

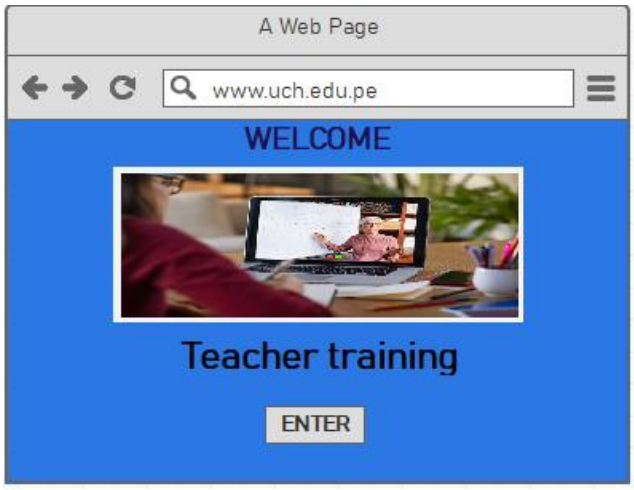

Fig. 6. Web page and its first welcome contact

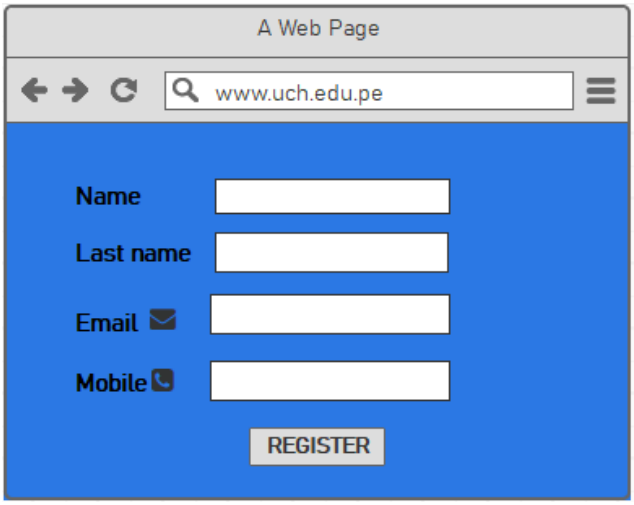

Fig. 7. User's registration

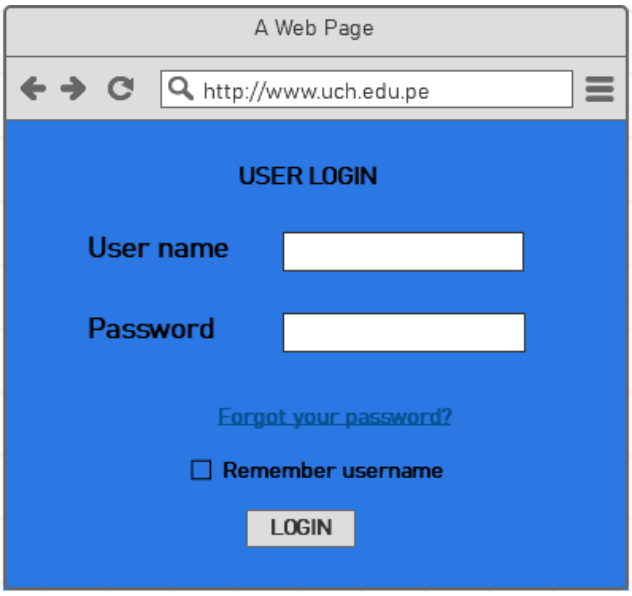

Fig. 8. Page dedicated to the user's login

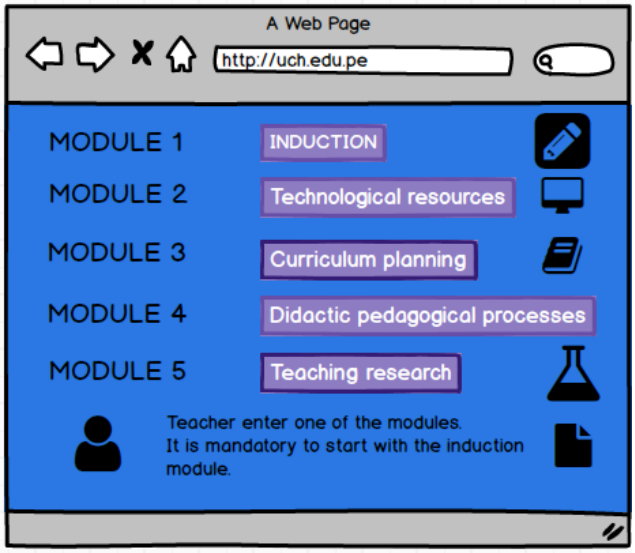

Fig. 9. Modules that can be chosen by teachers

Fig. 10. Technological resources

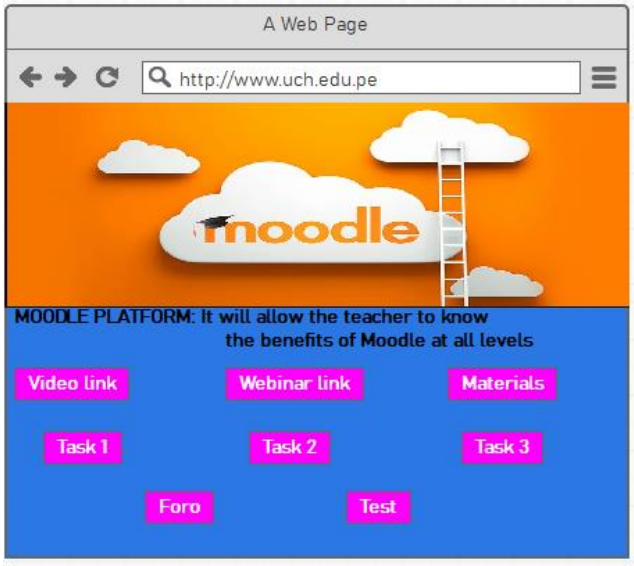

Fig. 11. General presentation of the Moodle platform

4.3 Validation of the proposed model

The criterion-referenced evaluation was performed to assess the effectiveness of the proposed model. The validation of the experts' judgment was carried out individually, without contact with other experts, so that there would be no suspicion at the time of scoring, this is called the selection of the experts' judgment by the method of individual aggregates. It is recommended that the number of experts be odd. It can range from 7 to more.

The pedagogy experts were considered. They evaluated according to the following criteria:

1. C1: Drafting. - The model is made with simple language.
2. C2: Objectivity. - The model responds to the objective of the project.
3. C3: Actuality. - The model is based on up-to-date topics.
4. C4: Organization. - The structure of the model has a logical organization.
5. C5: Sufficiency. - The amount of information in the model is satisfactory to meet the goal.
6. C6: Intent. - The model is adequate to reach the stated purpose.
7. C7: Consistency. - The model is based on aspects theoretical and practical of university pedagogy.
8. C8: Coherence. - There is a relationship between the dimensions and sub-dimensions of the proposed model.
9. C9: Methodology. - The model responds to the analysis of the diagnosis.
10. C10: Relevance. - The model is useful and suitable for the project.

The criteria were validated by experts, represented by E1, E2, E3, E4, E5, E6 and E7.

The scores range from 1 to 5 and are evaluated by the experts: 1 represents very poor; 2 poor; 3 average; 4 good; and 5 very good.

The result obtained by the expert is E1:4; E2: 4.44; E3: 4.65; E4: 4.34; E5: 4; E6: 4.08; and E7: 4.44.

The proposed model is validated, which represents the value of 4.27. Obtaining the total average of 85.5%.

Figure 12 shows the score by criterion, as well as the scores obtained by each expert. It is observed that in criterion C5, which has a lower score; those who stand out with a score of 3 by 2 experts. that the highest score is C4; 4 experts gave the maximum score which is 5. It will be considered in the lower scores obtained for continuous improvement.

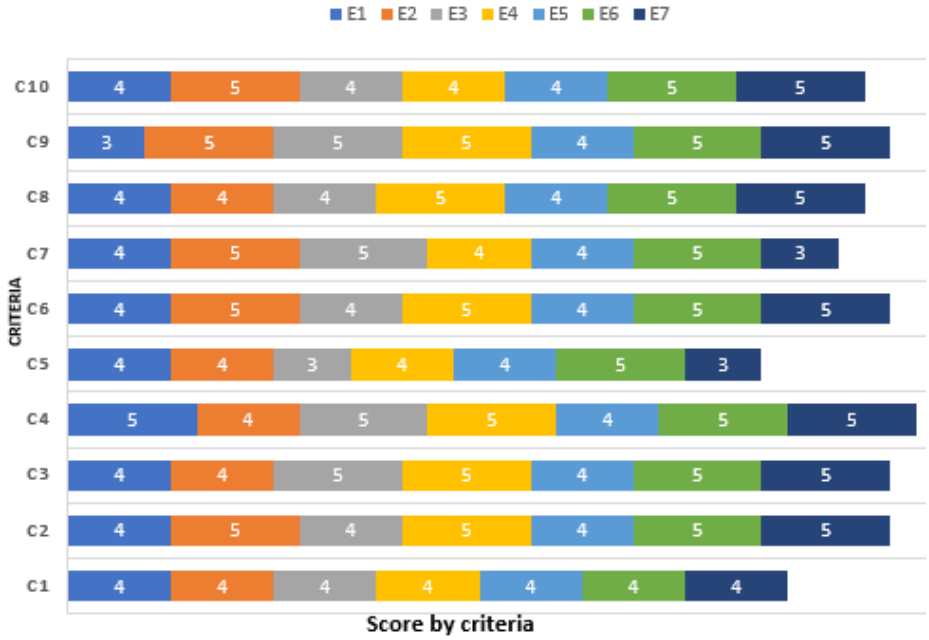

Fig. 12. Score by criteria

4.4 Proposed modeling

After conducting the analysis with subject matter experts, one module emerged, namely induction. This module is essential for all teachers entering the university for the first time. It will allow them to know the educational model of the university. On the other hand, some of the themes of the modules have been eliminated as well as their merging and insertion.

The modeling has taken as reference the confirmed and validated activity, in this sense it has served as input to identify the selected activities. It can be seen that these activities can be found in the proposed modules. The model will be implemented the following year. This model is validated by experts in pedagogy, teaching quality, ICT and research. The proposed model serves as a fundamental basis for the progressive

incorporation of other elements that may emerge during its implementation. The model presented in Figure 13 is the basis for promoting the creation of a technological area in the university, in this way we will have teachers who will benefit from the proposed model.

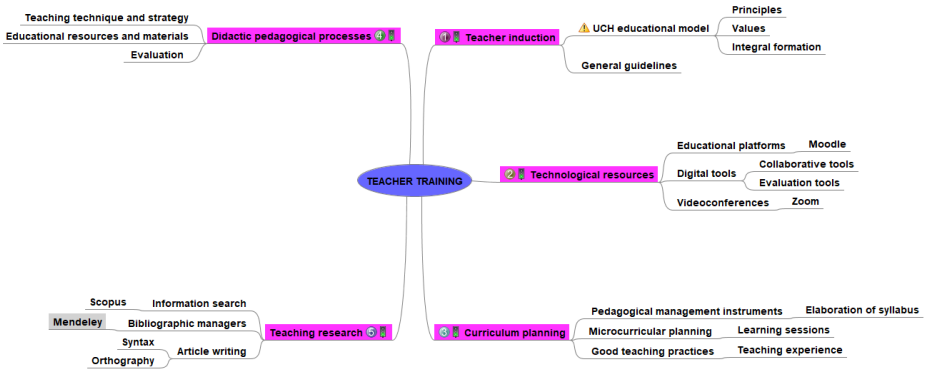

Fig. 13. Proposed modeling

5 Conclusions and future work

In this paper, the proposed model allows a systemic view for its implementation of virtual courses. The validation carried out by the experts on the model was accepted with 85.5%. A module has been incorporated, namely the initiation to teaching, which allows knowing the educational model of the university, as well as its organizational culture. It is recommended as future work, its implementation and then its commissioning, starting first with a pilot.

In addition, it is suggested that the administration be involved in a more continuous way, so that they can know more about the project being carried out.

One limitation has been the availability of time, since the project members are administrative. This has delayed the progress of the project schedule.

It is recommended to make a greater investment in the creation of a technological direction that can include not only the creation of virtual courses for teacher training but also the realization of other types of training that allow the teacher to have a more complete vision of his development as a person. and also, of his academic development. It is proposed to realize virtual courses for students through a mobile application.

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