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# THE TPACK MODEL TO PREPARE AND EVALUATE LESSON PLANS. AN EXPERIENCE WITH PRE-SERVICE TEACHERS USING SOCIAL NETWORKS AND DIGITAL RESOURCES

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It is essential to understand and manage technology for pre-service teachers in order to propose methodological, educational and assessment strategies that allow them to innovate and respond adequately to the demands of the educational system. The objective is to identify the elements that pre-service teachers use in learning situations for the production of digital educational resources created to teach using social networks through the TPACK rubric. This research was developed focused on a quantitative methodology and a descriptive design. The sample was formed by 32 pre-service teachers who attend an Information and Communication Technology Course in 2014, at the Faculty of Education, Universidad Católica de la Santísima Concepción. Main results obtained from the analysis of three educational resources (blog, Prezi and cartoons) indicate that they possess a low level of integration of curricular objectives and technologies; however, results show that students have a high level to select the technological resources in the design of didactic activities. It can be concluded that incorporation of the TPACK model, positively helps pre-service students to know how to integrate the teaching resources in an innovative way. It enables the achievement of an adequate articulation of technology in teaching and learning.

*Key words*: Lesson Plans, the Technological Pedagogical Content Knowledge, Initial Teacher Training, Social Networks, Information and Communication Technology

## 1 Introduction

Nowadays, it can see how ICT has revolutionised education studies show that education is being transformed through the integration of technology in many parts of the world [13, 27, 29]. Most of the changes are noted by authors who stated that ICT are fundamental in the learning, since the society is and will be invaded by them [4, 15, 16].

These changes are visible in the curricula that have been implemented in Chile, both in schools and in universities, emanating from the different curricular reforms proposed by the Ministry of Education. These educational policies regarding the integration of technologies in the initial and continuing training are closely linked with Latin America and its action plans about the Information Society [9, 10, 11] and they are also connected with the Goals 2021 [30], because they influence the

way to innovate and improve learning processes through technology. They are focused on teacher's education, as the key to a change in the way people teach and learn, and to promote a more flexible structure that is tailored to the needs of students.

According to ENLACES [12] the teacher training strategies in the educational use of ICT are primarily geared towards actual teachers. Therefore, it is necessary to link the reality of teaching practices in initial teacher training, to knowledge management "around the didactic construction, as a modality that facilitates the achievement of more autonomous learning, and the possibility of transferring it to promote dynamics relations of communication between the individual and group learning" [22].

This research seeks to strengthen existing educational processes, besides technological experimentation and creation of pedagogical and didactics models that can contribute to the generation of knowledge in incorporating technology applied in pre service teachers training. In this context, the Technological Pedagogical Content Knowledge, TPACK, was used as theoretical base [28, 37] because it articulates three areas: educational, technological and discipline; through activities that respond to the needs of curriculum and teaching to adapt their lesson plans.

Therefore, it is intended to answer some needs of pedagogical and technological nature, to develop instructional designs from TPACK model with the aim of articulating expert knowledge, teaching and technology as essential elements in teacher training. According to Lion [26] studies on educational models look for a new educational setting in the light of new scientific, pedagogical and technologies contributions applied to education. This is how mastering technology is fundamental to pre-service teachers to propose methodological, teaching and assessment strategies that allow them to innovate and respond adequately to the demands of the current education system.

### *1.1 Initial teacher education with ICT*

The reality of education nowadays is that most teachers have little knowledge of ICT beyond the computer, mobile devices, social networks and media. This is one of the main problems with teachers, the rapid evolution of the learning society, in which pre-service teachers are been educated into a culture where the meaning of their profession has changed [5, 16]. Therefore, trained teachers have to tech to a new are a generation of students belonging to the digital age, where information and learning require familiarity with ICT, and it is a requirement for their integration in the classroom.

Success depends significantly on the attitudes of teachers, "and even when teachers are competent in ICT and have a positive attitude towards it, they often fail to integrate it into their learning activities in the classroom" [43]. The explanation of this situation refers to the processes of initial and continuing teacher training.

In this context it is vital that teachers know the three dimensions or lines of action in ICT described by Gutiérrez [18] knowledge of the educational potential of ICT, knowledge of their learning potential and knowledge of the social contexts in which new media are developed and teaching contexts where they are used as resources. Also Tello and Aguaded [40] argue that teachers should be not a mere consumer of new resources, but also to be content creators and facilitators for access to information based on the research and reflection about new educational horizons for teachers.

### *1.2 Teaching and technology knowledge of contents*

The concept of the model was coined by Shulman [37] in order to identify the nature of the knowledge required to integrate ICT in teaching, preserving the relationship between disciplinary and pedagogical knowledge (PACK). Due to the invasion of technology in education, Mishra and Koehler [28] extend the idea of Shulman. They integrate ICT as an element into of the equation, developing the TPACK model: Technological, Pedagogical and Content Knowledge.

The TPACK is "a conceptual model that offers teachers a mental framework for thinking about the different areas of knowledge related to effective teaching and interaction of knowledge and skills necessary for the effective integration of technology" [44]

The three domains are essential for the successful use of technology in teaching and learning. They are a set of skills that span multiple disciplines and must be applied in specific situations to teach effectively with technology.

Figure 1 shows that there are seven different areas of integrated knowledge from educational, disciplinary and technological knowledge. All this knowledge must be considered individually and respect to their mutual interaction [28].

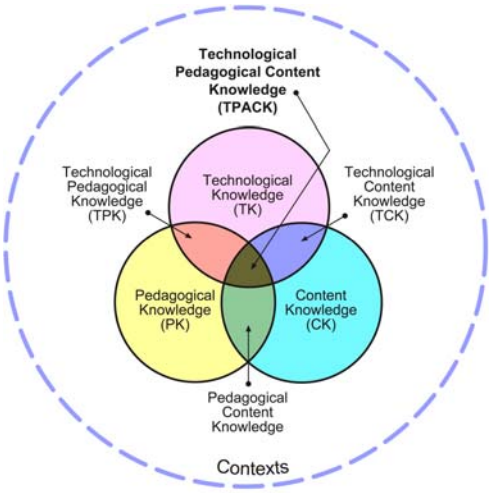


Figure 1. The TPACK Model (Source: Mishra and Koehler, 2006)

• Technological Knowledge (TK): These are skills to use technology at standard levels. It is the ability to learn and adapt to new technologies.

• Pedagogical Knowledge (PK): Knowledge about the processes, practices, methods of teaching and learning, values and goals in general educational purposes. It is understood as the construction of knowledge students acquire knowledge and develop habits of mind and positive disposition toward learning. Skills and knowledge related to general education, such as the classroom routine, planning, creation of working groups, and even discipline techniques.

• Content Knowledge (CK): Knowledge about what is taught or learned. Contents covered formally and informally by the teacher. It is knowledge and understanding of theories, concepts and procedures in a given field.

By linking these three skills emerge three other types of knowledge. Firstly, *Technological Pedagogical Knowledge (TPK)*, which is the ability to use ICT in a specific educational topic and how to implement plans changing the pace of the class, and even the use of tutorials, and materials made by the teacher. Knowledge about the functions and components of various technologies and their use in teaching is also important, as well as an understanding of the change that would occur in the classroom if these technologies were introduced. Secondly, *Technological Content Knowledge (TCK)*, refers to how to make good use of the technological knowledge that a person has developed. Such as, the use or development of databases or the incorporation of the appropriate ICT tools into the taught discipline. And thirdly, the Pedagogical Content Knowledge (PCK), which is similar to the idea of pedagogical content knowledge posed by Shulman [37]. It is about connecting ideas, trying to find alternative strategies to classical teaching, to transform different paths that lead students to change their present conceptions. All teachers should possess pedagogical knowledge for teaching.

Finally, if the three basic skills (pedagogical, technological and content) are related with the three that are generated from these, (educational content, technological content and technological pedagogical) knowledge can be extracted with experience in ICT, the Technological Pedagogical Content Knowledge, TPACK, that is defined as knowledge with experience, the use of ICT to support teaching strategies and methods in relation to their discipline.

Most of the research related with TPACK framework is focused on P-12. Some examples are Thai and Chuang [39] who proposed a "TPACK-in-Action model" to help in-service English teachers to integrate technology into language classroom in Taiwan, or Boschman, McKenney & Voogt [3] who studied what is the nature of design talk of a group of teachers during the design of technology-rich early literacy activities.

The development of TPACK in pre service teacher is more recently, and authors as Rienties, Brouwer and Baker [36] claim that research on how to implement the TPACK-framework and its validation in a higher education. However some interesting research is appearing in this context. Kurt, Mishra and Kocoglu [25] designed a 12-week TPACK development program for 22 Turkish pre service English teachers to examine their TPACK development. During this period, TPACK framework was presented to the pre service teachers; they developed technological materials, explored various technologies collaboratively, designed technology integrated lessons and taught in a real classroom atmosphere. Main results showed that there was a statistically significant increase in TK,

TCK, TPK and TPACK scores of pre service English teachers from the beginning to the end of the study. Another study was conducted by Ansyari [2] who developed a professional development programme for technology integration through a design-based research. The results of 12 English instructors suggested that all participants reported having positive experiences with the TPACK professional development programmes, and weaknesses were found related to time, technology exploration, and students' engagement. Also Tømte, Enochsson, Buskqvist and Kårsteinstudy [41] studied how online teacher education programmes from Sweden and Norway, may enhance innovative ways of teaching and learning with Information and Communication Technology (ICT) incorporating the TPACK-framework. Results revealed that even if online teacher education programmes represent good avenues for stimulating teachers and pre service to develop digital competence for pedagogical purposes, this aspect is poorly integrated within the actual programmes.

### *1.3 Digital educational resources as online communication tools*

A resource can be "content involving information and / or educational software, characterized not only as a resource for education but it can be used according to a particular teaching strategy" [34]. Meanwhile digital educational resources are materials formed by digital media and produced in order to facilitate the development of learning activities. A didactic material is suitable for learning if it helps the concept of learning, to acquire skills and to improve the individual's attitudes or values.

In this research, it worked with blogs, presentation software and cartoons. These digital resources were executed using different software for the production of content learning in different subsectors of learning. *Blogger* is a platform with a General Public License (LGE). It provides all the tools it need to start and make a blog. It is fully customizable and packed with advanced features such as editing HTML, mobile device and support publication, among many others. In the educational context, blogs have been used to enhance communication between students and teachers; they are also not geographically or temporally constrained. *Prezi* is a software with General Public License (LGE) to make presentations, it is used as a bridge between linear and nonlinear information, and as a presentation tool for brainstorming, either free or in a structured way. The text, images, videos and other means of presentation can be together. According to Prezi [33] "it lets move fluidly from the brainstorming process to the presentation of them." And on the other hand *Cartoons* is a cloud-based platform for the creation and distribution of animated videos. It allows users to develop a narrative video in which characters speak with lip sync and move around, and video presentations, in which a voiceover narrator talks about the images and supports that can also move.

## 2 Research Aim and Questions

This study investigates the following research question:

RQ 1: How can pre-service teachers integrate the educational, technological and disciplinary elements to design a learning situation?

The idea is to identify an educational model, which from a didactic configuration guide the pre-service teachers in the integration of technologies as mobile devices and social networks, in their learning processes. In this context, the main objective of this article is *to characterize the elements used in learning situations for the production of digital educational resources working with ICT.*

## 3 Research Approach

This research was developed at the Universidad Católica de la Santísima Concepción in order to meet current training needs of pre-service teachers from the Pedagogy in Primary Education, who use technologies to achieve teaching content integration through ICT resources. The University has taught Information Technology and Communication (ICT) as part of the generic and specific skills to be mastered by its graduates. This course include has 2 hours of classes per week during a semester, divided into the theoretical and practical part, totalizing 110 minutes. During that time, teachers need to cover the compulsory content. In its curricular activity program students have to design a lesson plans with integration of ICT, and they are invited to develop didactical resources to support teaching and learning processes, among others contents. The innovation consisted in upload all tasks to the Moodle institutional platform.

The framework has focused on quantitative methodology through a descriptive design that allows the search for new knowledge, under a positivist paradigm.

The sample was formed in a probabilistic and accidental way. It is formed by one of the three groups who completed the ICT course, with the participation of 33 students from the School of Education, Generation 2014. They are enrolled in the first year of training at the Faculty of Education. The group is formed by students between 18 and 28 years old, where 78.8% are female, and 21.2% are male. Most of these students come from public schools (n = 45.8%) and semi-public (n = 48.5%), and only 3.0% come from private schools.

Two methods were used to collect the information needed. The first one is the descriptive and structured observation, which permit a specific and intensive relationship between the researcher and the social fact or set of social actors [14]. The procedure was performed during the first semester, through field notes and photographic evidence.

The second one is the usability records of the Platform such as evidence, and the productions links of digital resources in Blogspot, Word Press and Prezi developed by pre-service teachers (all of them also were available on the web with public access). The exception was the Cartoons that were developed on Domo Animate, which at the time of preparation was a software General Public License (LGE), currently it requires a Premium account monthly payment.

Regarding to instruments for data collection, it was used a Rubric of observation, called *Rubric for Assessment of Technology Integration*. It consists of implementing the model developed by Harris and Hofer [19], based on four criteria of observation. Each criterion is focused on a scale from 1 to 4, indicating the level of integration of technology as a strategy to implement the educational, technological and disciplinary knowledge. It is important to mention that 1 means the lowest level of integration, and 4 the highest. This rubric was validated and it is authorized for its use since 2010 [20].

The results of the three products of the students are presented according to resource selection and use of technology in their educational projects. The emptying of the information is performed based on individual observation of the productions made by students, where Blogs, Prezi and Domo Animate were analysed according to the goals set by the course teacher for the production of each resource, and subsequently evaluated according to the rubric's criteria.

The information analysis is performed by descriptive statistics. To order data, the SPSS version 15.0 was used.

## 4 Findings

Descriptive statistic was applied to analyse collected data. The results were interpreted and discussed by answering the main objective of this research.

In relation to the design of a Blog (see Figure 2), the results show that 81.8% of students are *not aligned with curriculum objectives* of the selected technology (the blog) (*M*=1.21). This is because according to the TPACK model, students must have a pedagogical discipline knowledge enabling them to adapt or create new tasks that are suited to the learning needs of their future students. In addition, it need a solid pedagogical knowledge that enables a deeper understanding of the processes and strategies of teaching and learning. For this reason the 66.7% of the data suggests that the blog *does not support the teaching strategies* that pre-service teachers have developed (*M*=1.42).

Table 1. Results of the Rubric for Assessment of Technology Integration

| Digital Resource | Curriculum and Technology Objetives | | Teaching and Technology Strategies | | Selection of Technology | | Adequacy of the content teaching and techonology | |
|---|---|---|---|---|---|---|---|---|
| | *M* | *SD* | *M* | *SD* | *M* | *SD* | *M* | *SD* |
| Blog | 1.21 | .485 | 1.42 | .663 | 2.76 | .502 | 2.21 | .696 |
| Prezi | 1.94 | .242 | 2.21 | .485 | 3.85 | .442 | 2.33 | .479 |
| Cartoons | 2.06 | .242 | 2.64 | .489 | 4.00 | .000 | 2.64 | .489 |

Regarding the technological knowledge, the 69.7% of pre-service *used the blog properly but not exemplary* (*M*=2.76), because they failed to achieve the curricular objectives and teaching strategies into their digital resources. Regarding the adequacy of the content, teaching and technology, the data show that 57.6% of students *made a partial articulation among themselves* (*M*=2.21), within the educational planning (see Table 1).

According to the Table 1, the interdisciplinary nature of digital resources particularly affects the design of activities. That is why the results, in relation to resource Prezi (see figure 3), showed an increase in the control of resources and its relationship to the teaching-learning process.

In relation to curricular objectives and technologies, it observed a stronger link in the design of activities with Prezi, since 93.9% of students *achieved the goals of the curriculum through the use of technologies*. Regarding teaching strategies and technologies 72.7% *minimally supports teaching strategies* (*M*=2.21). It was observed that the Prezi application does not have a clear didactic purpose, and technological use is dominant in this category. According to the selection of technology, 87.9% of students *exemplarily implemented the use of Prezi* regarding the curriculum objectives as teaching strategies (*M*=3.85). Finally, the adequacy of the three areas of the TPACK model is only partially articulated because 66.7% *articulates the content and technology selection prior to the didactic planning* (*M*= 2.33).


Figure 2. Example of one blog Profile updated by pre service teachers


Figure 3. Examples of Prezi presentations elaborated by pre service teachers

The actions that have been made less through ICTs have been related to self-regulation and regulation of student learning. As proof, the use of Cartoons (see figure 4) evidence the greater proximity to the model TPACK in designing activities. The results show that in activities linked to these kind of digital resources students were able to link the curricular objectives with technologies.

93.9% partially aligned with one or more curricular objectives (*M*= 2.06). This indicates, there must be an improvement in establishing objectives to be achieved at the beginning of activities and these objectives must be visible when interacting with the resource. The 63.6% of students supported teaching strategies through technologies (*M*=2.64). This means that they visualize the Cartoons as an excellent strategy and activity that promotes learning. Regarding the choice of technology, 100% of students used, in an exemplary manner, animations made in Cartoons regarding curricular objectives and teaching strategies (*M*=4.00). Finally, the adequacy of the 3 elements was achieved in 63.6% articulating each other within the didactic planning (*M*= 2.64) (see Table 1).


Figure 4. Examples of Catoons designed by pre service teachers

## 5 Conclusions and discussions

According to the results that match with Koehler and Mishra [23] the importance of the TPACK model is shown in the design of educational activities because they allow students to "learn in contexts that honour the rich connections between technology, the topic (content) and the media to teach (pedagogy)".

Another important element for successful technology integration is the curricular content learning processes related to the content and the intelligent use of educational technologies. Therefore "to integrate educational technology in teaching planning of teachers should be organized around the requirements of the curricula to effective teaching practices and the possibilities and limitations of available technologies" [19]

It is considered that the creativity that students develop around the TPACK model generates motivation for the activities. Both educational theory and teaching ICT gain from the TPACK proposal as a reference point since according to [38] is not the only point to represent the educational complexity.

It is important to establish that the impact of ICT in teaching and learning depends on the students' familiarity with ICT. Most pre service teachers in first year have no experience in teaching and digital tools related to learning. This fact that also was stated by Wetzel, Buss, Foulger & Lindsey [45] who found evidence from their study indicates students struggle with the complexity of integrating the

TPACK domains when they express their limitations in learning and using TPACK, as well as a) limited knowledge of pedagogy and restricted TPK and b) limited examples of technology modelling within the courses.

The students' experience with any of these resources (Blog, Prezi and Cartoons) meant that at the end of the course students were able to visualize a proper articulation between teaching, disciplinary knowledge and technologies. Since the start of activities discipline and technology were the focus giving less importance to the didactic area. This results are consistent with Hofer and Grandgenett [21] and Koh and Divaharan [24], who suggest there was a need for greater emphasis in teaching/modeling of Technological Content Knowledge.

However, it is necessary to establish a specific context for students to achieve the use of technologies based on the Chilean curriculum, which has to be focuses and linked with practising in schools, as stated Polly, Mims, Shepherd, and Inan [32].

Similarly, to provide suggestions for activities for the use of the Blog, Prezi and Cartoons as a resource for teaching strategies, and consider the formative and summative assessment in the design process of activities, as well as Kurt, Mishra and Kocoglu [25] do in Turkey. Thanks to their 12-week TPACK design and taught in a real classroom atmosphere. Results showed that "there was statistically significant increase in TK, TCK, TPK and TPACK scores of pre service teachers of English from the beginning to the end of the study.

The adoption of the methodology TPACK positively encourages students to devise technology as an integral aspect of the planning and implementation of education and to distance oneself from technology-centric approaches in integrating ICT into the curriculum. Finally this research opts to present TPACK experiences to motivate new insights that address the educational context, as a rising form of educational knowledge.

However, this research provides important information about students' weakness that will allow it working on improve the design of the ICT course incorporating TPCK model not only as a way of evaluate digital resources produced by pre service teachers, but thinking strategically into the curriculum of the pre service methods courses exposes. Many of the limitations of this study come from the fact that have been carried out in single-semester ICT course, as well other authors report [8, 24, 31] rather than in technology-infused methods courses, which are offered over time throughout the program.

Efforts will be focus in the courses design as well in aligned with their three instructional stages: fostering acceptance, technological proficiency and pedagogical modeling, and pedagogical application.

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