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Critical thinking with TPACK in bachelor's degree in Literature and Spanish Language

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Abstract: The article presents the results of the research variables involved in an online training program that develops critical thinking and the Technological Pedagogical Content Knowledge (TPACK) model. Action research is carried out, within the framework of the ICT research line and the learning process, with a sample of 42 students from the first semester of the Bachelor's program in Literature and Spanish Language at the Universidad Surcolombiana, who participated in the pre-test. -test and post-test. In conclusion, the online training program strengthens the development of critical thinking with the application of the TPACK model.

Keywords: critical thinking, TPACK model, Learning manager, ICT, online training program.

Introduction

According to the Ministry of National Education (2021), critical thinking is considered an intellectually active and skillful process of conceptualizing, applying, analyzing, synthesizing and/or evaluating information evidenced by observation, experience, reflection, reasoning or communication leading to action.

Bermúdez (2021) states that the construction of knowledge and the intellectual production of the student is built through autonomous, participatory and collaborative learning. Due to the above, it is necessary to implement innovative and creative pedagogical models that allow the involvement of technological means as an elementary tool in the teaching and learning process, thus achieving a significant transformation in the student.

Figure 1 complements the previous concept, revealing thinking skills (Creamer, 2011). According to the psychologist Nickerson (1986), critical thinking is defined as "the property or domain of a mental, psychic or practical nature that individuals opt for and carry out procedures of some activity whose purpose is to achieve some objective, guided by knowledge and/or previous knowledge" (p. 410). Critical comprehension assumes the discourse so that the reader makes pragmatic, strategic or projective inferences.

In the same way, UNESCO (2021) states that, within Sustainable Development, learning must prepare students of all ages to find solutions to the different problematic challenges of today and tomorrow, understanding that education is transformative and allows as individuals they are able to make their own decisions and, at the same time, propose innovative ideas that benefit society; the above refers to Critical Thinking.

Figure 1. Critical Thinking Skills.

Source: Aguilar Vargas, Alcántara Llanas & Braun Mondragón, 2020.

Critical thinking and the Technological Pedagogical Content Knowledge (TPACK) have achieved a representative change and impact on teachers, strengthening the teaching and learning process of students (Leal Urueña & Rojas Mesa, 2020).

Theoretical references

This research study impacts the different degree programs offered by the Surcolombiana University to people interested in carrying out professional training, especially the academic program of Literature and Spanish Language. Returning to the fact that there are few investigations carried out at the local, national and international level in this field, which allow the strengthening of critical thinking supported by matrices or methodologies in accordance with new trends and what is required by globalization. To continue with the critical development, the TPACK model proposed by Mishra and Koehler (2016) is besought, a model integrated by the knowledge that the teacher requires to manage ICT efficiently in teaching. Figure 2 presents the Content (CK), Pedagogy (PK) and Technology (TK); Similarly, the TPACK approach benefits three knowledge bases in isolation, emphasizing the types of knowledge found at intersections: Pedagogical Content Knowledge (PCK), Technological Content Knowledge (TCK), Technological Pedagogical Knowledge (TPK) that employ Technology, Pedagogy and Content, and Technological Pedagogical Content Knowledge (TPACK) (Mkoehler, 2012).

The previous evidences the TPACK model as an adequate educational response to relate knowing what, knowing how and knowing where, with a tendency to adopt, adapt, create and share resources in the classroom to complete the teaching process and learning (Jiménez Sabino & Cabero Almenara, 2021).

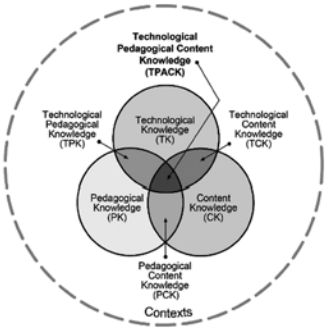

Figure 2. TPACK Model.

Source: Technological, Pedagogical Content Knowledge (TPACK) (Mkoehler, 2012).

Table 1 lists some of the main research results carried out in other contexts with the TPACK model in education.

Table 1.

Research results.

Title	Author / Year	Description
Promoting Technological Pedagogical Content Knowledge (TPACK) of Teachers in training: A Quasi-Experimental Field Study (Germany)	(Lachner *et al.,* 2021)	The research presents a specific intervention of the selected subject to generate the culture of the use of the TPACK model in future teaching professionals, based on training practices based on evidence, with a sample of 208 teachers in training. This study intends, through the TPACK model, to implement the technologies in the classroom. Finally, the effectiveness of the TPACK model was evaluated through a quasi-experimental field study, with significant results for self-efficacy related to technology and its proper use in the process as a means of support in the classroom.
Technological Content Pedagogical Knowledge (TPACK): Design Selection Analysis and Data Analysis Techniques in Secondary School (Indonesia).	(Saputra & Chaeruman, 2022)	The research study is based on the teaching and learning process integrated with the technologies that teachers currently require in their professional practice, using a documentary analysis of articles indexed in the SCOPUS magazine, published in 2020.

Technological Pedagogical Content Knowledge Practices in Higher Education: First Impressions of Trainee Teachers (Turkey).	(Çam, Gürcü & Koç, 2021)	Research that consisted of evaluating the perceptions of educators with the practices of technological pedagogical content knowledge (TPACK).
The TPACK model, in the teaching praxis in an Argentine university. Knowledge and teaching practices around the didactic-technological knowledge of the content (CDTC) in university classrooms (Argentina).	(Flores & Ortiz, 2019)	The research evidences the knowledge and practices that teachers have in relation to technological pedagogical content knowledge (TPACK) in the humanities careers classroom at an Argentine university, based on a multiple case made up of teams of teachers from six subjects and an intra-methodological triangulation (primary and secondary sources), of researchers and teachers participating in the validation in a qualitative study.
Study of the integration of ICT in teacher training through the TPACK model (Ecuador).	(Antonio & Burgos, 2020)	The present research study based on the investigation of the scope of the integration of technologies, pedagogy and content (TPACK) in educational processes and professional teacher improvement through formation in digital skills in times of Covid-19. Based on the research carried out on the TPACK model, a diagnostic and evaluation instrument was developed that will guarantee the quality of digital education in

		the teacher; obtaining as a result favorable levels in the integration of technologies with pedagogy and with disciplinary content inside and outside the classroom.
The TPACK techno-pedagogical model and its impact on teacher training: a review of the literature (Rep. Guatemala)	(Balladares-Burgos & Valverde-Berrocoso, 2022)	The implementation of ICT in content and pedagogy promotes the development of new digital skills in teacher training, improving the teaching and learning process. The techno-pedagogical model of the TPACK content has facilitated the acquisition of new competencies in the university teacher. The objective of this research article is to present a broad and detailed vision from the beginning to the variants of the TPACK theoretical model and, likewise, the necessary foundations to support this model as an elementary basis for digital education in professional teacher training and practice.
ICT and its impact on academic results: an analysis from the TPACK model.	(Morales, Cote, Molina Bernal, & Rodríguez-Jerez, 2019)	The implementation of Information and Communication Technologies (ICT) in education has become necessary and innovative in the teaching and learning processes. The purpose of this investigative study is to analyze the events

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		of ICT in the results obtained from the saber 11 tests carried out in 2016, in Cundinamarca and Bogotá; taking the TPACK model as a reference for study. As an instrument for the collection of information, a questionnaire was designed and applied that made it easier to know the teacher's competencies of the TPACK model. The type of research was quantitative (linear regression and ANOVA), selecting as the independent variable the average of the results obtained by the students conformed by educational institution.
A professional training model supported by a personalized learning system for the development of teachers' TPACK (Thailand).	(Chaipidech, Srisawasdi, Kajornmanee & Chaipah, 2022)	The research study the effects of an andragogic design of teacher professional development with a learning system integrating pedagogical technological content knowledge (TPACK). With a sample of 161 science teachers from 92 secondary schools located in northeastern Thailand who participated voluntarily; and the results obtained showed that teachers significantly improved the dimensions of the TPACK model in relation to teaching in the classroom.

TPACK model and active methodology, applications in the area of mathematics. A theoretical approach (Ecuador)	(Rodríguez Solís & Acurio Maldonado, 2021)	The research study of systematic review aims to identify innovative technology strategies through the implementation of the technological pedagogical content knowledge model (TPACK). Likewise, the active methodology of the teachers of the third year of basic education for the subtraction with regrouping seminar. The methodological support worked was qualitative research, applying the documentary research model; Coming to the conclusion that digital didactic tools promote new knowledge processes, improvement of learning times and levels of effectiveness in problem solving.
Technological Pedagogical Content Knowledge (TPACK) in Action: Applying Learning in the Classroom by future teachers PST (Philippines)	(Santos & Castro, 2021)	Technological Pedagogical Content Knowledge (TPACK) is the ideal model that allows the integration of different technological tools for the teaching and learning process. This research evaluated the application of the TPACK model of preservice teachers in different public study centers around Bulacan (Philippines). The participating teachers in the sample were evaluated by their cooperating teachers and as a tool to validate the information, it was supported by an interview with future

		teachers and supervisors. The result showed that teachers in training have solid knowledge in each of the elements that are part of the TPACK model. The technological tools that educational institutions have were evaluated as adequate tools. However, it is necessary to establish educational policies that promote training in the proper use of technological tools that help students and teachers in the teaching and learning process inside and outside the classroom.
Pedagogical technological competence of the content in the area of Language and Literature (Ecuador)	(Cando, Tituaña, Cando & Lema, 2018)	The objective of this research was to determine the level of competence that Basic Education teachers have in the area of Language and Literature in relation to the Pedagogical Technological knowledge of the TPACK Content. The approach used for the investigation was quantitative with a descriptive scope. A survey was applied to 48 teachers using a questionnaire, having the TPACK model as a reference. This model is ideal for teachers, because it allows strengthening the knowledge, competencies, and skills that teachers require to integrate technologies efficiently in the teaching-learning process of any area of

		knowledge. According to the data analyzed, it allowed determining that teachers have a very high level of technological, pedagogical and content competencies individually. However, they present shortcomings when articulating the content technology, pedagogical technology, and content pedagogical technology competencies.
Teacher Competence Analysis with TPACK for K-12 IA Education (South Korea)	(Kim *et al.,* 2021)	The research determines the necessary competences that the teacher requires to improve the teaching and learning of Artificial Intelligence (AI) taking technological pedagogical content knowledge (TPACK) as a reference. It was necessary to identify the educational resources that are currently available on AI and the necessary foundations that AI teaching requires. Based on the evidenced findings, the teaching competencies for the training of the AI implemented the TPACK model are proposed. In conclusion, the teachers who guide the AI seminar require the implementation of the TPACK model in the classroom so that students develop skills in solving problems using technologies.

Thought processes: How to develop them through research within the framework of Teaching for Understanding (Epc)?	(Bermúdez Vásquez, 2021)	The present research study with a qualitative approach, carried out at the Colombus American School Educational Institution, in the municipality of Rivera, Huila, Colombia, aims to assess the progress of the thought processes of the students (1st, 2nd and 3rd primary school grades) through research in the pedagogical and didactic process within the framework of teaching for understanding. Considering Research as a process that seeks to solve a problem; achieving that students become competent, critical, purposeful and creative beings in decision making.
Didactic strategy to awaken literary sensitivity in high school youth	(Lasso Ramírez, 2020)	Having a good literary habit allows the human being to develop competencies in the perception of reality, in decision-making, oriented to solving problems, building life projects, handling good assertive and receptive communication, having a critical position of the things; All of the above is achieved through the experiences acquired during their formation. Today it is necessary to involve the student in the management of technological tools as a means of training and didactics in the teaching

and learning process. This research seeks to structure a didactic strategy to awaken literary sensibility in the teaching of literature in ninth grade students of the El Juncal Educational Institution in the municipality of Palermo, Huila, Colombia.

Source: self made.

The learning management system (LMS) is considered as a support tool for the teaching and learning process in the educational field, in distance or blended mode. In the same way, it is a means of solving the different companies or educational centers in charge of online formation and education (Merriman, *et al.* 2016).

ICTs or so-called Information and Communication Technologies are tools used for the processing, administration and distribution of information with technological elements, such as computers, telephones, televisions, etc. (UNESCO, 2018). As a complement to the above, a virtual educational platform is a computer environment in which there are grouped and optimized tools for teaching purposes. Its function is to allow the creation and management of complete courses for the Internet without requiring deep programming knowledge.

Figure 3 shows the necessary skills for the teacher as proposed by UNESCO. It is important that the professional teacher involves technological tools in the teaching-learning process with their students, in an interactive, dynamic, active and motivating way, complying with the development of competencies according to the area of knowledge that they wish to strengthen during the course academic process.

Figure 3. ICT skills for educators.

Source: ICT educator skills (UNESCO, 2008).

The European magazine Horizon Project (2017) made a publication called "Digital Literacy in Higher Education, Part II", where it states that national and international companies need human personnel with skills and competencies to be successful. Table 1 shows the competencies and skills for the business context, each of them being important according to the managers of the companies. Table 2 describes a comparison made in the period 2015-2020, which shows the skills and competencies that employees must acquire to be part of their companies.

Table 2.
Competences and skills for the business context.

	2015		2020
1	Complex troubleshooting	1	Complex troubleshooting
2	Coordination with others	2	Critical thinking Creativity
3	Human management	3	Human
4	Pensamiento crítico	4	Management
5	Negotiation	5	Coordination with others
6	QA	6	Emotional intelligence
7	Service orientation	7	Judgment and decision making
8	Judgment and decision making	8	Service orientation

9	Active listening	9	Negotiation
10	Creativity	10	Cognitive flexibility

Source: Bryan *et al.,* 2017.

Metodology

The research approach allows verifying the behavior of the critical thinking variables and the application of the TPACK model with the aim of applying an online training program that develops critical thinking, supported by the TPACK model, to solve the difficulties present in first-semester students of the Degree in Spanish Literature and Language, with a sample of 42 students, who participated in the pre-test and post-test that was approved and validated by experts, with a consistency and reliability index according to Cronbach's alpha of 0.9. The variables used are described below:

Critical thinking

AA = Analyze – Apply
RS = Reason – Synthesize
EV = Evaluate – Validate
TPACK Model
TK = Technological Knowledge Variable.
CK = Content Knowledge Variable.
PK = Pedagogical Knowledge Variable.
PCK= Pedagogical Content Knowledge Variable.
TCK = Technological Content Knowledge Variable.
TPK = Pedagogical Technological Knowledge Variable.
TPACK = Technological Pedagogical Content Knowledge Variable.

The mentioned variables are involved in an online training program, an LMS was used that allowed verifying the behavior of each of the variables before and after applying the training program.

Results and discussion

During the development of the online training program, the pre-test and post-test are applied to undergraduate students.

For each proposed question, five response alternatives were established: Totally disagree **(TDS)**, Disagree **(TD)**, Neither agree nor disagree **(NDA – NDS)**, Agree **(DA)** and Totally agree **(TDA)**.

Table 3 shows the result of the pre-test before the online training program. In the case of critical thinking, 38.1% were found for the RS variable (Reason - Synthesize); students present shortcomings when understanding how the parts of a text are articulated to give it a global meaning. In the case of the TPACK model, the variables CK (Content Knowledge) and PK (Pedagogical Knowledge) obtained a percentage result of 44.0% and 41.7% respectively, evidence that students have some difficulty when identifying what does critical thinking consist of and its main characteristics to develop it; in addition to the shortcomings when adapting teaching styles to transformational leaders (students), using different learning styles.

Table 3.
Pre-test results.

Variables	TDS	DSA	NDA-NDS	DA	TDA
AA	11,1%	14,3%	32,5%	28,6%	13,5%
RS	13,1%	38,1%	31,0%	10,7%	7,1%
EV	15,5%	28,6%	35,7%	13,1%	7,1%
TK	3,6%	4,8%	29,8%	38,1%	23,8%
CK	8,3%	19,0%	44,0%	19,0%	9,5%
PK	9,5%	19,0%	41,7%	19,0%	10,7%
PCK	21,4%	35,7%	31,0%	7,1%	4,8%
TCK	16,7%	31,0%	35,7%	11,9%	4,8%
TPK	15,5%	23,8%	35,7%	14,3%	10,7%
TPACK	19,0%	45,2%	16,7%	11,9%	7,1%

Source: self made.

Table 4 describes the representative results of the post-test after applying the online training program to the students of the first semester

of the bachelor's degree in Spanish Language and Literature. A significant percentage of 44.0% with a DA response was found for the case of Critical Thinking corresponding to the variable R-S (Reason - Synthesize) where the students agreed; evidencing ability to identify a correct structure in an argument and the existing relationship between paragraphs within a text. With a percentage of 57.1% being the highest for the TPACK case corresponding to the variable CK (Content Knowledge) obtaining as a response from the students to agree; Demonstrating a good capacity when using methods and strategies to develop critical thinking.

Table 4.
Post-test results.

Variables	TDS	DSA	NDA-NDS	DA	TDA
AA	4,0%	7,9%	11,9%	43,7%	32,5%
RS	2,4%	8,3%	29,8%	44,0%	15,5%
EV	8,3%	10,7%	27,4%	39,3%	14,3%
TK	0,0%	1,2%	16,7%	29,8%	52,4%
CK	1,2%	6,0%	8,3%	57,1%	27,4%
PK	2,4%	4,8%	10,7%	35,7%	46,4%
PCK	2,4%	4,8%	14,3%	54,8%	23,8%
TCK	0,0%	2,4%	7,1%	35,7%	54,8%
TPK	1,2%	6,0%	15,5%	50,0%	27,4%
TPACK	0,0%	2,4%	9,5%	35,7%	52,4%

Source: self made.

Table 5 lists the representative percentages that were obtained in each of the variables evaluated in relation to critical thinking and the TPACK model, taking into account the application of the Pretest and Postest. In the case of critical thinking, the AA variable is found with a percentage of 32.5% in the pre-test with an NDA-DSA response, rising to 43.7% in the post-test with a DA response, that is, there was an increase of 11.2%; in the RS variable, the highest percentage in the pre-test was 38.1% with a DSA response, likewise in the post-test the significant percentage was 44.0%, with an increase of 5.9% in DA; with a percentage of 35.7% where the respondents stated that they were in DSA in the pre-test, against 39.3% in the case of the post-test, obtaining DA as an answer, an increase of 3.6 was obtained. % for the case of the EV variable; In the case of the TPACK model, the TK variable has a significant percentage for the pre-test test

with 38.1% with a DA response, in the post-test test the representative percentage was 52.4% with ADD, an increase of 14.3%; In the case of the CK variable, 44.0% was the highest percentage with the NDA-NDS response option, while in the post-test, 57.1% corresponded to being DA, which means an increase of 13.1%; with a considerable percentage of 41.7% where the respondents stated that they were NDA-NDS, against 46.4% with a TDA response corresponding to the PK variable, 4.7% was the increase obtained for the mentioned variable; In the case of the PCK and TCK variables, the representative percentages were 35.7%, with those evaluated being DSA in the pre-test and 54.8% with a TDA response in the post-test, thus achieving a representative difference of 19.1%, being the two variables with the highest percentage in the TPACK model; with a percentage of 35.7% with an NDA-NDS response for the TPK variable in the pre-test and 50.0% whose response was DA for the post-test, an increase of 14.3% was obtained; As the last variable, we have TPACK with a percentage for the pre-test of 45.2% where those evaluated stated that they were DSA, going to 52.4% with an ADD response in the post-test, thus achieving a difference of 7.2%.

Table 5.
Comparative Pre-test and Post-test.

Variable	Pre-test		Post-test		% Differential
	Higher %	**Answer**	**Higher %**	**Answer**	
AA	32,5%	NDA-NDS	43,7%	DA	11,2%
RS	38,1%	DSA	44,0%	DA	5,9%
EV	35,7%	DSA	39,3%	DA	3,6%
TK	38,1%	DA	52,4%	TDA	14,3%
CK	44,0%	NDA-NDS	57,1%	DA	13,1%
PK	41,7%	NDA-NDS	46,4%	TDA	4,7%
PCK	35,7%	DSA	54,8%	DA	19,1%
TCK	35,7%	NDA-NDS	54,8%	TDA	19,1%
TPK	35,7%	NDA-NDS	50,0%	DA	14,3%
TPACK	45,2%	DSA	52,4%	TDA	7,2%

Source: self made.

Conclusions

As part of the diagnosis made to the students of the first semester of the Spanish Language and Literature program, it was found that the participants present shortcomings in critical thinking in the analyze-apply, reason-synthesize, and evaluate-validate categories.

The online training program is a good alternative to develop activities that allow strengthening the competence in critical thinking with an appropriate model, in this case with the TPACK approach.

The criteria requested in an online training program are strengthened with the TPACK model using synchronous and asynchronous services from the learning manager, improving the technological, pedagogical and content component, strengthening critical thinking.

The variables related to apply, synthesize and validate are necessary in the development of critical thinking.

That said, information and communication technologies guarantee innovation when using pedagogical and didactic strategies by the teaching professional for the teaching-learning processes.

The integration of ICT in the classroom is the responsibility of the professional teacher to guarantee a dynamic learning environment, with active methodologies; The student is a fundamental actor in the application of ICT with collaborative, participatory, investigative, communicative and management dynamics, essential in any educational center.

Taking into account what was stated by Balladeres-Burgos *et al.*, (2022) and Cando et al., (2018) allows corroborating with the purpose of this research, where they mention that the implementation of Information and Communication Technologies in the content and pedagogy allows the development of new digital skills in professional teaching practice, improving the teaching and learning process in students and, in turn, it is necessary for education centers to implement innovative models that strengthen the teaching and learning processes of teachers and students. In addition, structuring the TPACK model in the micro-curricular planning of each subject that the teacher guides, thus guaranteeing significant learning experiences with ICT.

It is important to propose the result of the research in plans, programs and/or strategies as part of the institutional educational project, whose objective is to guarantee quality in the academic training process in accordance with the Sustainable Development Goals (SDG) as the responsibility of each country.

Finally, from the analysis obtained in the pre-test and post-test related to the analyze-apply category, a representative difference of 11.2% is evident; Similarly, for the category of technological knowledge (TK), there is a significant increase of 14.3%; Similarly, in the case of the categories of pedagogical content knowledge (PCK) and technological content knowledge (TCK), an increase of 19.1% was obtained, respectively. That is, it allows us to sustain that the online training program with the use of technological mediations effectively strengthens critical thinking in students.

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