

Pedagogical Knowledge of Pre-Service Teachers from a Brazilian Virtual University: Analysis of Data collected by TPACK Survey

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Abstract

Currently, knowing the technologies and their pedagogical use is essential for teachers and teams of all levels and modalities of education. This view is materialized in approaches such as Technological Pedagogical Content Knowledge (TPACK), the theoretical framework of this paper. The aim of this article is to analyze the data collected on Pedagogical Knowledge (PK) collected by using the TPACK Survey. The questionnaire was applied to undergraduate students at a virtual public university, and there are quantitative and qualitative analyzes, respectively, of closed and open questions. As a result, it can be seen that the respondents perceive themselves in skills and competences related to PK and believe that the lack of time to study as the main factor that hinders learning.

Keywords: Distance education; Higher education; TPACK.

Introduction

As the influences of innovative and active teaching and learning methodologies increase, Digital Information and Communication Technologies have also been more important in the daily life of the population, as well as in didactic practices. The teaching and learning processes must adapt to this reality through differentiated teaching, online, hybrid, active and with appropriation of technologies.

However, in any educational scenario that arises - especially in Distance Education (DE) -, the human factor is fundamental:

- Students, who needs to be the center of the teaching and learning processes;
- Teachers or professors, who remains a teaching reference and promoter of didactic situations; and
- Multidisciplinary team, responsible, in partnership with the professors, for didactics and learning experience.

In this sense, it is important, at least by the multidisciplinary didactic material production team, to retain the Technological Pedagogical Content Knowledge (TPACK), an explanatory model of teaching action developed by Koehler and Mishra (2005; 2008). Based on Shulman's approach (1986; 1987), the authors indicate that it is not enough to know the specific content to be taught, or the pedagogical precepts and not even just the technology: it is in the intricate relationship between contents, pedagogy and technology that one finds the intentional didactic appropriation of technology in teaching and learning processes.

The teaching practice, then, must have bases for the application of the appropriate technology in order to teach a specific content, in a certain context. Bates (2015) agrees: educational

agents must know how to use technologies – not one or the other technology, but the fundamentals that are the cornerstone of the intentional use of technologies, according to the teaching objectives or the skills provided in the planning of the didactic action.

Thus, it is not possible to think that technology, by itself, makes teaching or learning more or less effective: the role of those who plan and execute the intentional pedagogical use of this technology is fundamental, as well as those who actually implement and follow up these practices. This implementation of technology, so that it is not merely instrumental, is not simple and encompasses a series of challenges for institutions, such as making teachers aware of a significant use of technology and the composition of a competent multidisciplinary team for this vision.

Brazilian official documents, such as laws and decrees, reinforce this view: according to the instruments for the evaluation of higher education courses (Brasil, 2017), the use of technologies and Virtual Learning Environments (VLE) in the teaching and learning processes must be intentional and with didactic purposes. For example, to obtain the maximum concept concerning to technologies, it is necessary to demonstrate that they allow the execution of the pedagogical project of the course, guarantee digital and communicational accessibility, promote interactivity between teachers, students and tutors, ensure access to teaching materials or resources at any time and place and enable different learning experiences based on their use (Brasil, 2017).

As already mentioned, in the current scenario of education, which is increasingly complex, the teacher alone cannot centralize the teaching process, especially in DE. Oliveira (2019), for instance, indicates that a multidisciplinary team, with a variety of skills and abilities, is needed to support the professor to put teaching and learning processes into practice towards specific knowledge. In addition to professors, instructional designers, art, audiovisual and information technology professionals contribute to the use of pedagogical technologies and organizational aspects. Working in multidisciplinary teams can provide students with a much more meaningful and effective learning experience with the appropriation of technologies.

The research of this paper took place in the Virtual University of the São Paulo State (UNIVESP), a public higher education institution that offers only distance education, in undergraduate courses in several areas, such as engineering and teacher training. At the institution, professors are exponents in their areas of teaching and research that count on the support of a multidisciplinary team for the development and production of teaching materials, in order to optimize the use of the technologies and active methodologies adopted. Professors have direct contact with instructional designers who support them in the didactic transposition of their knowledge for distance education, through the introduction of active methodologies and intentional pedagogical use of technologies such as interactive resources, video classes, illustrations, open educational resources and activities, according to the skills that is wanted to develop. All of these actions occur through the use of an VLE capable of integrating native or non-native tools, such as virtual libraries and videoconferencing applications.

In this sense, the objective of this paper is to discuss the data collected on Pedagogical Knowledge (PK), a fundamental part of TPACK Survey, applied to UNIVESP's students. For reasons of space, it is not possible to discuss the whole instrument in this article that contains more than 50 questions and was translated into Brazilian Portuguese. As a justification, it is evident the need to reflect on the intentional pedagogical use of technologies, especially in future teachers who studied in distance education.

The theoretical framework, as already pointed out, is the TPACK which, according to Koehler and Mishra (2005; 2008), starts from the principles of Shulman (1986; 1987) to debate how technology can be appropriated in the teaching and learning processes. In other words, how a complex body of technological, pedagogical and content knowledge's interact, as shown in Figure 1, within a context, and using specific content teaching and learning with appropriation of technologies in a significant and structured.

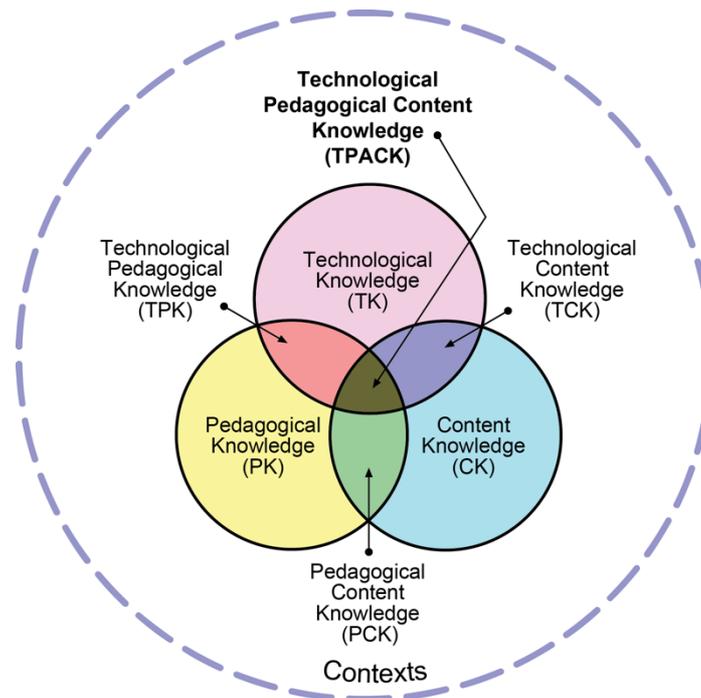


Figure 1: TPACK theoretical framework

(<https://upload.wikimedia.org/wikipedia/commons/e/e8/TPACK-new.png>)

Still for Koehler and Mishra (2005; 2008), this explanation of the teaching action must be thought through several standpoints, for example, how a didactic representation of the contents of an area of knowledge can occur with the use of appropriate technologies and didactic strategies that apply for effective and meaningful learning. These actions must also consider the contexts in which the educational processes take place. In this sense, there is no single pedagogical solution valid for any and all situations that arise in the educational context. Each situation that occurs in a classroom or other formative space can be solved with its own combination or a joint weave of the elements that make up the TPACK(Oliveira, 2020).

Materials and Methods

The data collection instrument of this research, whose analysis was part of this researcher's doctoral, was a survey, applied via Google Forms to students from four undergraduate courses at Univesp (Physics, Chemistry, Biology and Mathematics). This instrument is a set

of questions that the informant answers without the need for the presence of the researcher (Andrade, 2010).

The instrument was applied through the internet, since this favors the collection of a larger amount of data and optimizes this collection in a considerable spatial dispersion, such as this research. In addition, the procedure is supported by the TPACK bibliography: according to Chai, Koh and Tsai (2016), this is one of the most used forms of data collection in the last decade in investigations on the subject.

The instrument's questions were translated into Brazilian Portuguese and adapted based on the Survey of Pre-service Teachers' Knowledge of Teaching and Technology (Schmidt et al., 2009). The result involves multiple-choice questions – whose tabulation and analysis are quickest – as well as open ones – whose results return richer information to the investigator, with more complex analysis (Andrade, 2010).

The survey applied in the research for the doctoral study of this researcher contains, in total, more than 50 questions. Due to the spatial limitation of this article, it is only used those focused on Pedagogical Knowledge (PK), which uses the “Totally disagree”, “Disagree”, “Do not agree, nor disagree”, “Agree” and “Strongly agree” scale for the following assertions :

- 1: I can learn from the assessments I make;
- 2: I can understand and adapt to the teaching methods available in the online environment;
- 3: I have my own style to study and learn;
- 4: I can follow my progress with the different tools in the online environment;
- 5: I can use different tools in the context of online exercises;
- 6: I can monitor and evaluate my difficulties and understandings with the online environment; and
- 7: I can organize and manage online activities within the time provided by the course.

It was also left a free written field right after. The translation, adaptation and dissemination process of the Survey followed the main notes of Andrade (2010) regarding the clarity of the language, the adequacy of the vocabulary to the public, unbiased questions and logic in the ordering of the questions.

Multiple choice questions were analyzed quantitatively. As for the field for open response, it was applied Bardin's (2007) approaches, who explain about the organization of the collected data, it's coding into smaller units of meaning and its categorization, before or after the analysis itself. It is in this way that was possible to start to analyze and infer results, in order to provide debate and problematization of the data obtained.

The locus of the research, as said, is UNIVESP, the only public university in São Paulo-Brazil dedicated exclusively to teaching with technologies and distance education. Created in 2012, the institution's missions include, among others:

- Knowledge as a public good;
- Universal access to education;

- The application of innovative methodologies; and
- The intensive use of technologies in educational contexts.

It has offered its own undergraduate courses since 2014, when 3,330 vacancies were made available for the following undergraduate courses: Degree (teacher training) in Physics, in Chemistry, in Biology, and in Mathematics, as well as Production and Computer Engineering. Other entrance exams took place in 2016, 2018, 2019, and 2020 in order to add up to, currently, about 50 thousand active undergraduate students.

Results and discussions

The number of students enrolled at Univesp at the time of this research was 1,275, and 323 responded to the survey – which is equivalent to a sample with 95% confidence and a margin of error of 5%. In the Mathematics Degree course, of the 434 enrolled, 115 responded to the survey, that is, 26%. In Physics, of the 217 enrolled, 61 responded to the survey, that is, 28% - the highest proportion of respondents to the questionnaire per course. Of the 242 enrolled in Chemistry, 55 responded to the survey, that is, 23%. Finally, in the Biology, of the 382 enrolled, 92 answered the survey, that is, 24%.

The collected data were analyzed against the theoretical framework adopted and already explained. In this sense, the graphs contained in the following figures referring to the questionnaire's assertions, one by one, and the respective discussions are based on the TPACK bibliography. This step starts with the Figure 2, which summarizes the responses to assertion 1. All the graphics follow this subtitle: dark blue corresponds to "I totally disagree", red corresponds to "I disagree", green corresponds to "I neither agree nor disagree", purple corresponds to "I agree", and light blue corresponds to "I totally agree".

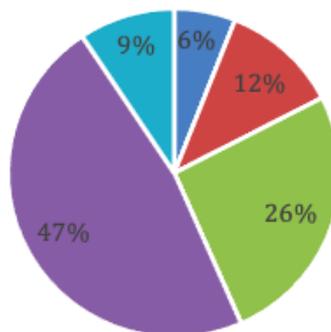


Figure 2: Responses to statement 1: "I can learn from the assessments I make".

The majority (56%) of graduates indicate that they agree or fully agree with the perception of their ability to learn from the assessments they make. The assertion in Figure 2 is the one with the lowest percentage of total agreement among all the others.

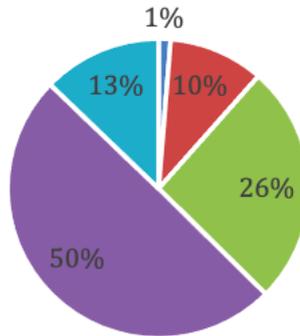


Figure 3 – Responses to statement 2: “I can understand and adapt to the teaching methods available in the online environment”.

Figure 3 is still focused on teaching. It demonstrates that 63% of respondents consider that they are adapted to teaching methods available in VLE.

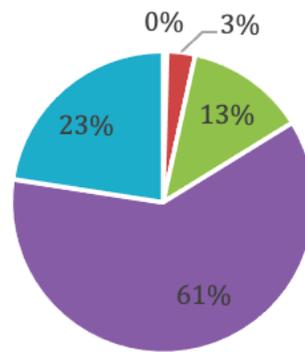


Figure 4: Responses to statement 3: “I have my own style for studying and learning”.

Figure 4 reflects more about another point in the educational process. Regarding their own learning, the percentage of respondents who claim to have their own style for studying and learning grows to 84%, the highest among the research’s assertions.

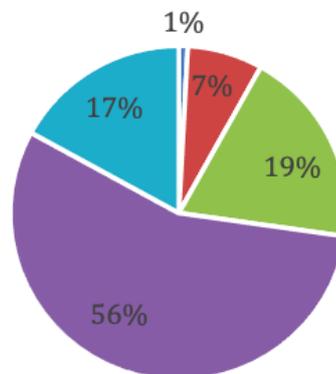


Figure 5: Responses to statement 4: “I manage to follow my progress with the different tools of the online environment”.

Still on learning, but now specifically online, 73% of graduates say they use the tools of VLE to monitor their progress. As shown in Figure 5, the data on learning, in the respondents' perception, is clearer than the data on online learning.

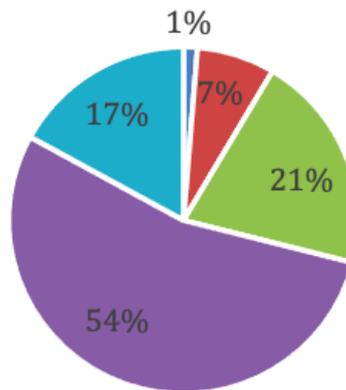


Figure 6: Responses to statement 5: “I can use different tools in the context of online exercises”.

In the continuity of the data on learning, there is the Figure 6. About using online tools for learning, the number is very close to that of the previous question: 71% of the respondents agree or totally agree.

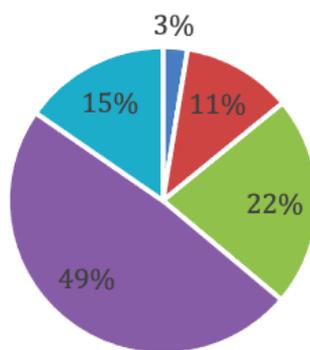


Figure 7: Responses to statement 6: “I manage to monitor and evaluate my difficulties and understandings with the online environment”.

As part of the learning process, respondents also indicate some autonomy in the use of VLE: 64% indicate that they agree or fully agree with the statement “I can monitor and evaluate my difficulties and understandings with the online environment”. This data is shown in Figure 7, which already brings contextualized and autonomous learning (such as “in the online environment in which I study”, in the interpretation of the respondents), so the approval falls in relation to the data on isolated learning.

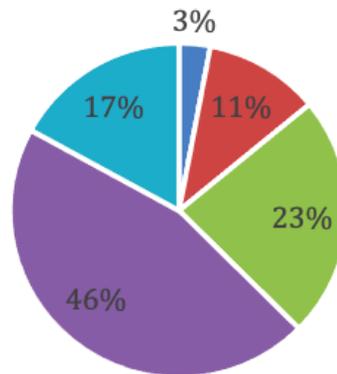


Figure 8: Responses to statement 7: “I can organize and manage online activities within the time provided by the course”.

Finally, Figure 8 adds, still, the organizational factor on student learning: the time defined by the University for learning. Regarding this capacity for self-management of learning over the course of the courses, 63% of respondents indicate that they are able to maintain the organization of activities within the schedule.

It is relevant to realize that all assertions have a percentage of respondents who agree or totally agree above 50%. An important factor, considering that it is a teacher training course – serving both as a view on their learning and on how they can be able to teach (Oliveira, 2019).

Two main statements stand out: the one with the highest percentage of agree or totally agree and the one with the lowest. It is worth mentioning that both do not refer to the context of the course in which the respondents are students, that is, they are more general.

The first, with the lowest percentage of agreement, is “I can learn from the assessments I make”, with 56% (Figure 2). It is relevant that students understand this and manage, in their practice, to change this reality, since a basic assumption of Pedagogical Knowledge is the understanding of how each student builds their knowledge, which involves feedbacks and feedback (Shulman, 1986; 1987; Koehler& Mishra, 2005; 2008). At the same time, it is an indication to the institution to apply more formative assessments.

At the other extreme, the statement “I have my own style to study and learn” is the best rated: 84% of respondents agree or totally agree (Figure 4). It is important that graduates understand that they have a particular style, but more than that: they need to know what that style is and, at the same time, they should be able to recognize this in their future students as well (Oliveira&Piconez, 2016; Koehler&Mishra, 2005; 2008).

In the open question, the main perceived category is the lack of time for studies, something that is reflected especially in statement 7 (Figure 8). Two examples: “the material made available is very good, but due to my lack of time, I end up using only video classes” and “this semester it is difficult to reconcile so many activities with the time available for study”.

This is a recurring point in Brazilian distance education, since students, especially at the beginning of courses, believe that this modality is easier and takes less time than classroom teaching (Oliveira, 2019; 2020). However, practice shows that this is not the case.

Conclusions

Conducted in the context of the doctoral research of the author of this article, linked to the Faculty of Education of the University of São Paulo (Oliveira, 2019), this investigation attempted to debate the data collected in application of TPACK Survey to UNIVESP students.

Respondents demonstrated an understanding of the questions present in the translation into Brazilian Portuguese and adaptation of the Survey. It is worth mentioning that, perhaps, a translation more faithful to the original for the pedagogical contents may make more sense for research in classroom contexts, like face-to-face education. For distance education, the translation presented helps to understand the pedagogical terms related to digital contexts.

In addition, it is possible to perceive that the graduates consider having a considerable mastery of the skills and competences aimed at Pedagogical Knowledge. It is worth highlighting the percentage of respondents who demonstrate awareness of having particular learning styles – in the hope that they will recognize the same in their students and thus know how to apply teaching practices to serve them.

Regarding the lack of time for study, it is up to the institution and the teachers to define the necessary workload for teaching and learning in order to comply with the skills and competencies provided for in the official curriculum and, at the same time, not make the participation of students unfeasible. It is necessary to meet both the needs of the student and the training curriculum.

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