

Pedagogical Content Knowledge: a professor's practice in a nursing program

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Abstract

Main objective: to understand the relationship between professor action and reflection in the construction of Pedagogical Content Knowledge (PCK). Methods: qualitative research from symbolic interactionism; simple case study, based on a semi-structured biographical-professional interview, observation and recording of a class and *think-aloud* interview. Main results: the inductive analysis of the data generated the categories action and teaching reasoning. Main conclusion: professors associate PCK with the mechanisms through which they can interact with students and make the class sufficiently fun and meaningful for them to internalize it; the context in which it is taught -university, students, educational system- is central to PCK; PCK is a particular construction of each professor to improve and strengthen his or her pedagogical practice. Keywords: Nursing education. Higher education. Teaching. Nursing professors. Knowledge.

Introduction

Pedagogical Content Knowledge (PCK) is the disciplinary, didactic and contextual knowledge which professors use to teach and make said knowledge understandable. ¹Shulman described PCK as a special blend of subject matter and pedagogy;² in other words, the knowledge professors use to transform content into representations that can be assimilated by students.³ PCK has been investigated mainly in elementary and high school education, for natural and exact sciences, namely mathematics, physics, chemistry, among others.⁴⁻⁶

In higher education, research has been conducted on education degrees and on some engineering degrees.^{7,8} Regarding health sciences, some studies have been conducted in specific courses, such as anatomy and physiology.^{9,10} For nursing, studies such as Souza's highlight PCK as the basis of professional knowledge for teaching.¹¹ Studies have also been initiated with novice nursing professors.¹²

Training nursing professionals with critical capacity, skilled in their disciplinary work, competent and responsible for providing wellbeing and comprehensive care to patients depends to a large extent on achieving excellence in faculty training, being student-centered and with quality instruction that promotes effective learning.¹³ While knowledge of the subject matter is essential for university education, in itself, it does not provide clues as to how to make it understandable to students. Therefore, it is necessary for professors to transform their knowledge in didactically effective ways.¹⁴

This article discusses the relationship between pedagogical action and reflection in the construction of Pedagogical Content Knowledge (PCK).

Method

This research on the construction of PCK is a qualitative study,¹⁵ under the approach of symbolic interactionism.¹⁶ It had as only case study,¹⁷ a morphophysiology professor coursing second semester at the Universidad de Antioquia Nursing School, who met the requirements of being a health-related professor and being recognized as a "good teacher". The acknowledgement as an expert professor was obtained with a survey of students coursing final semesters and faculty professors who recognized him as: a professor "*always willing to help and motivate his students*", whose classes are "*dynamic and diverse*", with "*ease in conveying his knowledge*", who "*allows the integration of knowledge*", and with "*a good relationship with his students*".

The following methods were used for collecting information: the semi-structured interview, observation and audiovisual recording of a class and the *think-aloud* interview. After reading the project and accepting the objectives, the participant signed the Informed Consent approved by the Bioethics Committee at the Universidad de Antioquia School of Medicine (Act 015 of August 15, 2019).

The semi-structured interview lasted 90 minutes, and was recorded and transcribed in its entirety. For the observation of the cardiovascular morphophysiology class (conducted on

August 26, 2019 and lasting 100 minutes), two recording cameras were available; the researcher's role was that of a passive participant, as he did not intervene and was only observant to identify professor-student interactions.

The semi-structured interview was read and reread, which made it possible to get a sense of the participating professor's discourse and perceptions. On the other hand, when watching the class recording, it was intended to verify the congruence between what was said by the professor and what was observed in the class, and relevant episodes of professor-student interaction used in the *think-aloud* interview conducted 48 hours after the class were identified and edited. *Think-aloud* protocols, or *think-aloud* interviews, are rooted in cognitive psychology; ¹⁸ these interviews allow participants to watch themselves in action and to reflect on previous interactions.

The data analysis process was carried out inductively with the reading of the biographical interview; in it, meaningful phrases were selected, grouped, and related to the research objectives; then the same was done with data obtained from the *think-aloud* interview. After reading and rereading all the data, and through constant comparison, it was possible to group them into categories and label them; they were described seeking cohesion and coherence among them until subcategories were defined to answer the research question. ¹⁹ Once the findings were described, we proceeded to discuss them.

Results

In this study on construction of PCK, the emergent categories, *pedagogical action and reasoning*, refer to the participant's appropriation of the teaching area (morphophysiology) and his didactic strategies. *Pedagogical Action* refers to the participant's engagement in planning the course and in taking methodological action to favor the student's understanding; it is supported by the subcategories: Subject Appropriation and Didactic Strategies (master class, clinical case, analogies, comparisons and example, video, clinical reasoning exercises, questioning, among others).

The participant, coordinator of the theoretical-practical Morphophysiology course at the Universidad de Antioquia Nursing Program, celebrates the fact that this course is taught by nurses specialized in Physiology, unlike other nursing schools, where these courses are mostly taught by physicians: *"a course with a great advantage, that we were all nurses for nursing; that helped a lot"*.

This course has been progressively restructured, refining the contents and orienting it to the nursing context to favor understanding of topics, even if some of them take longer than planned, depending on the knowledge needs of the students: *"a new order for the course modules was proposed, according to the life cycle, with good results, and we have sought to articulate it with others, such as Pharmacology, also in charge of nurse professors, so that when students are attending Cardiovascular Morphophysiology, they also get to see Cardiovascular Pharmacology, thus enabling a more meaningful learning experience"*.

In nursing, in addition to learning about healthcare as an experiential category, the understanding of normal physiological processes will allow students in clinical practices to learn about pathology: *"What I think they need by the time they get*

to these healthcare practices is that, based on what is normal physiology, they can then understand what is abnormal".

The interviewee considers it fundamental that students learn to take care of themselves and not only focus on course contents, and aspires that along the learning process they recognize other areas of their development: *"you are not only a student, forget it!, you are a person, rest, sleep, eat!; you will never learn if you're tired, and that is what you are training your brain to do!; I do not like pupils struggling with learning, because they do not only have one class, they take four classes and they have many other things"*.

The *Didactic Strategies* subcategory informs the resources that the professor deploys to encourage student participation and self-construction of knowledge. Given the diversity of concepts and contents related to morphophysiology, the professor considers important to have a global idea of the students' pre-knowledge, in order to avoid methodological gaps in learning: *"I try to recapitulate on previously seen topics to make associations, and thus explain it again to the students, to give answers to the concerns or gaps that have remained"*.

The master class, with engaging and experiential dynamics, is a necessary dialogic experience to explain and describe the theoretical components of morphophysiology, which relates to the characteristics of students: more visual, frequent users of social networks and technological devices and platforms: *"a masterful course, but that has been evolving into a very fun course that moves along with them, especially, in the area of morphology, where they must color structures, because the amphitheater is often unavailable; or in the area of physiology, I have them do, for example, videos; I make games with them, to loosen them up, a kahoot or a test"*.

In class, the professor used a clinical case to stimulate student engagement and, as the case is being read aloud, they clarify concepts, which activates their pre-knowledge and develops their technoelect: *"I use clinical cases at the beginning or end of the class, because it enables an approach to healthcare experiences, increasing the student's motivation towards the subject"*.

In order to interact with the student, materialize teaching and facilitate learning, the informant associates everyday issues with physiological processes, uses colloquial language, images, directed questions and comparisons. For example, the professor compared heart valve movements to opening and closing a door; explained the musculoskeletal system through sports injuries or tendon injuries based on anatomical and physiological pre-knowledge; compared the sinus node to a light switch and, using the example of an auditorium, illustrated the invisible atrial repolarization on the EKG as when someone taller obstructs the vision of the person standing behind, among other examples.

Using colloquial language, the professor conveys a concept with an example or a comparison, with expressions such as: *"remember that"*, *"it is as if, for example..."*, *"it is like when you..."*, *"realize that..."*, *"ultimately..."*. Also, for him, video is a medium that facilitates recall and understanding of information and to explain relevant clinical aspects, such as the one he presented in the class on the Valsalva maneuver and its usefulness in cardiac emergency care.

His professional experience as a nurse allows him to guide the students' thinking towards real clinical situations that

they may encounter in their clinical practice and professional life. In the class observed, he presented the case of Wolff-Parkinson-White Syndrome (WPW) to illustrate how heart rhythm disorders are often unknown, an example he then associates to the physiology of sports and early diagnosis to avoid cardiac complications in high-performance athletes. This integrates the electrocardiographic concepts taught into a real clinical context, making it easier for students to understand them.

Questions and encouragement for students to ask them are resources used by the professor to clarify doubts, concepts, make clarifications that are necessary to understand the subject and as input to associate concepts with their experiences and clinical practices and, very often, to reaffirm subject knowledge.

As an example of the above, a student asks a question oriented to its application in clinical practice, from which the professor infers that the student has already had experience with patients, and uses it to retake concepts seen and to elaborate an answer, not only to the concept, but also to the clinical situation that the student is trying to clarify.

The professor uses diagnostic aids – X-Rays, ultrasounds, CT scans or EKGs - to suggest how to acquire practical skills, and with them brings students closer to experiential learning or situated learning, simulating practical contexts and encouraging a deep dive into the subject matter.

Pedagogical Reasoning presents the reasons why the participant believes he is recognized by the academic community as an expert professor, by establishing assertive communication paths with students and implementing different methodologies and didactic strategies: *"it is not about age, an expert professor is the one with whom the student considers that has had significant learning; we had a professor, a microbiologist, very good knowledge-wise, but with many problems in his relationship with students. If there isn't that feeling and that assertive communication with the professor, he might be very good, but it won't work"*.

The participant considers that curriculum knowledge is necessary to articulate scientific, pedagogical and contextual knowledge. Regarding the context, he compares the role of the operating room nurse in Colombia with Spain, where they have autonomy -prepare sedation, and even perform basic orotracheal intubation- while in Colombia the operating room nurse is limited to assigning operating rooms to the different specialties: *"it is the context of what the nurse has to do; I think it's necessary to know how to really articulate this issue of competences with this pedagogical process, to be able to frame it within what is a specific knowledge or know-how"*.

Regarding evaluation, the participant favors insights from interpretation and clinical correlation -with short clinical cases, diagrams or drawings, among others- over traditional written evaluations, closed-question or multiple-choice. In addition, he considers that there should not be strict rules for evaluation; from his practice, he has understood that by playing or in collaborative learning groups, tests generate less stress and contribute to discussion and knowledge application: *"I make a game, if there are 50 questions in my midterm and I have 20 students, I give them 25 questions to choose, and each one has the right to ask as if it were 'Who wants to be a millionaire', and ask for help from the public, and a phone call,*

and 50/50. Who conducts it? I do it; and so, it's a very friendly chat, and that takes the tension away".

The interviewee disagrees with an evaluation as a measurement instrument, because he has had students who are very good and engaged in class, but when faced with the test they become blocked; there are others who are very good in practical activities but completely lost theory-wise. He acknowledges feeling disappointed when students do poorly in tests and from the midterm feedback, he realizes that this is mostly due to question misinterpretation or inadequate reading comprehension: *"you think they understood when they leave your class, and then you can see the level of frustration I feel during the grading process; they take the theoretical-practical test and they do... terrible; so, I feel frustrated!"*.

Reflecting on questions in the classroom, additional to being an opportunity to elaborate an answer tailored to the knowledge being constructed, it allows students who refrain from publicly expressing their concerns to clarify concepts.

Students ask various kinds of questions. Sometimes, because they are taking notes, they ask questions about topics already explained; also as a result of conceptual gaps, or experiences with sick relatives, or to confirm their concerns about being nursing assistants in hospital institutions: *"the student almost always, when he speaks from the text, quotes the text; he says: 'teach, I did read', or 'I understood', that is, he uses words that are very clear of what the analysis actually is, the understanding of a text, or of a video; when it comes from an experiential place, the question has very unique features, very characteristic and even permeated by their own past experience. If the question is very explicit or experiential, they say: 'professor, is that my mom', my dad is...', 'professor, I had a patient', 'is that I was in a unit', or 'once I took care of a gentleman', things like that..."*.

Upon identifying a student's lack of clarity about a key concept, the professor recycles information to help the student understand the concept.

Discussion

For Correa Bautista, PCK is knowledge in constant transformation influenced by factors such as disciplinary training, teaching experience and observations of classroom experiences; ¹⁰ conditions that are related to the interviewed professor's pedagogical knowledge to teach his discipline, knowledge resulting from his classroom experience and which is an unfinished personal construction, which begins when the person becomes a university professor and that must continue to build up for the continuous improvement of teaching mediated by a reflective process.

According to Martínez and Valbuena, PCK refers to specific professor knowledge that allows him/her to understand the aspects that facilitate or hinder the ability to learn the content of a specific topic, to know the conceptions of students of different ages and backgrounds about a particular content, and to use strategies such as analogies, examples, explanations and demonstrations to enable the understanding of disciplinary content. ²⁰⁻²²

The construction of PCK by the participating professor is given by his specific knowledge on nursing and human morphophysiology, by his knowledge of his students and by the quality of his relationship with them, inside and outside the classroom. This last aspect has allowed him to detect students' doubts or struggles in learning and, through the use of

various didactic strategies, try to conduct his teaching with clarity and effectiveness.

With the clinical case, he seeks to motivate students towards a concrete clinical situation to strengthen clinical reasoning, which means performing the best judgement-based action in a specific context.²³ With the example, it aims at easy and practical understanding of knowledge and concepts; this should be timely, draw interest, be clear and understandable.²⁴ Video, on the other hand, facilitates the construction of meaningful knowledge; however, its use requires the presence of the professor, since it is the professor who determines how, when and for what purpose it should be used, giving it meaning and educational value.²⁵ Questions are used to stimulate class participation, which allows students to learn from their own concerns and those of the group, and makes the class a space for interesting engagement.²⁶

Pedagogical reasoning is a cyclical process that includes preparing the class with an educational intention in mind, selecting teaching methods, representing contents and how to adapt or adjust them to the students' characteristics.²⁷ The participating professor stated that he reflects with the students after the meetings, as each group is a different experience that contributes to the course building process; he also recognizes that being an expert professor depends on his disciplinary competencies, the meaningful learning of his students and the assertive communication that allows him to establish a trusting relationship and facilitates the teaching process. For him, knowing the reality in which students live, the influence the university has on their lives and the environment in which that relationship takes place determines the success rate of education.

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There is no perfect formula that describes an expert professor; however, there are qualities and skills that can be attributed to a good professor, including being responsible, flexible, concerned, compassionate, cooperative, creative, dedicated, determined, organized, engaging and empathetic.²⁸ The students attending the course regard the interviewed professor as an expert professor, they enjoy his classes and learn with his particular way of teaching. Therefore, the construction of PCK in health sciences does not have to be different from that in natural sciences, since the construction of PCK to improve and strengthen pedagogical practice depends on each professor.²⁹

Conclusions

The professor associate PCK with the mechanisms through which he can interact with his students and make the class sufficiently fun and meaningful for them to internalize it. Creativity and the use of different didactic strategies individualizes PCK construction. In the teaching-learning process, the ideal scenario would be for scientific, pedagogical and contextual knowledge to have the same degree of importance. An affective and emotional component of respect and trust is relevant for the construction and development of PCK.

PCK, guided by the professor's emotions, reflections and reconstructions, is characterized by its pedagogical reasoning around professional practice, and not only by having a large number of examples, analogies or representations of the subject matter. This knowledge is also affected by the professor's personality, thoughts and actions.

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