

Design and validation of a questionnaire to assess the Pedagogical Content Knowledge of Colombian Physical Education students in the practicum

Noelva E. Montoya-Grisales^{1ABCDE}, Alejandro Almonacid-Fierro^{2ACD}, Dora I. Arroyave Giraldo^{1AD}, Karla B. Valdebenito González^{2D}

¹ Universidad de San Buenaventura, Medellín, Colombia.

² Universidad Católica del Maule, Chile

Authors' Contribution: A – Study design; B – Data collection; C – Statistical analysis; D – Manuscript Preparation; E – Funds Collection

Abstract

Background and Study Aim In the training of Physical Education teachers, the practicum is considered a final stage of the training. The practicum implies an amalgamation and connection of the different knowledge acquired at the University and that, when contrasted with the real classroom practice, plays a fundamental role in the future professional development. The purpose of this study was to design and validate a questionnaire to measure the Pedagogical Content Knowledge of the Physical Education teacher trainee in the context of the practicum.

Material and Methods The participants were 146 practicum students of the Bachelor's degree program in Physical Education from four Colombian universities (115 men, 31 women, with an average age of 25.7 ± 5.2 years). A non-experimental descriptive cross-sectional study was conducted in two phases, the first one: content validity and the second phase related to the analysis of psychometric properties.

Results A Content Validity Ratio of .92 was presented, which indicates a very high content validity based on Lawshe's model and with a sample of 10 expert judges in the field. In the exploratory factor analysis by the principal component analysis method and varimax rotation, 7 dimensions were proposed, with 36 items explaining 66.78 of the total variance of the instrument. The internal consistency was very satisfactory ($\alpha=.9$).

Conclusions The questionnaire provides a valid, trustable, and specific instrument, which allows identifying the knowledge that a Physical Education practice student has about pedagogy, context, evaluation, teaching strategies, students, experience, and content. Furthermore, understanding this type of knowledge is a precondition that can allow improving the curricular designs of Physical Education degree programs.

Keywords: pedagogical content knowledge, physical education, practicum, teachers, training, measurement instrument.

Introduction

From the perspective of teacher training, the practicum represents the final moment of training. The practicum has a meaningful value for future professionals, since it is the first moment where the future teachers are given a leading role to face the reality of the classroom in all its complexity [1, 2, 3]. It is in the practicum when teachers in training, connect the different knowledge learned at the University defining their trajectory and teaching identity, with experiential, disciplinary, and curricular knowledge that is strongly influenced by the first professional experience [4, 5, 6]. The literature states that experiential learning is defined as the process by which the individual learns to act directly in a given situation through reflection on action as a process of knowledge production [7].

The practicum is recognized as one of the most

critical aspects of teacher training since it has a great impact on the quality of teachers [8, 9, 10]. The practicum represents a complex experience for students since it is experienced as an emotionally, physically, and interpersonally demanding process with significant consequences on the development of the teacher in training and their continuance in the profession [2]. The literature highlights the need for training programs to take responsibility for the tension between experience versus the current demands of teaching and learning, through the incorporation of activities explicitly directed toward understanding students' pedagogical knowledge through reflection on experience [11, 12, 13, 14, 15].

In the case of practical training in Physical Education, studies identify the elements that characterize this period, as well as the need to bring university classes closer to the school reality [1, 5, 16]. There is also a diversity of approaches to how school Physical Education should be organized,

which leads to a diversity of models and approaches that future teachers should know and experience. The discipline has characteristics where the context of content development is treated in different spaces than those of the other disciplines, adding to the complexity of teaching the specific content in Physical Education [17, 18, 19, 20].

In the field of practicum in Physical Education, the concept of Pedagogical Content Knowledge (PCK) is approached, which refers to the interactions with pedagogical purposes that take place in the classroom [21, 22, 23]. PCK tests the reflective action of the future teacher according to the needs of the students. Didactically, the contents are aimed at the appropriation of personal, theoretical, or practical elements by the students, and it is the teacher's function to adapt them to the dynamics of the context [24, 25, 26, 27]. PCK facilitates teachers and practicums to transpose disciplinary knowledge into teachable knowledge, so that it can be learned by their students, choosing the best examples, analogies, and demonstrations [14, 28].

Authors emphasize the need for initial training programs in Physical Education to implement pedagogical mechanisms that encourage trainee teachers' awareness of their relationship with their knowledge. The programs must contribute to the construction of PCK, through the management of all the knowledge in real teaching and learning situations [29, 30, 31]. This is the very heart of PCK, as it is the teacher who uses different resources, sources and elements of the context to integrate the background knowledge to be taught in a understandable way to the students [23].

PCK is directly influenced by the previous life, school, sport, academic (in the context of university training), and professional experiences to which trainee teachers of Physical Education have been and are subjected [30, 32, 33]. In initial training programs in Physical Education, environments conducive to the development of PCK can be designed based on the consideration of, for example, the place where pedagogical practices will be developed, the characteristics and number of students, etc. [1, 5, 16, 34]. Based on the propositions of authors [35, 36, 37], some inferences can be made about the probable tasks performed by the PCK in teaching practices, such as (i) receiving, through reflections, information from dilemmas that arise in teaching and learning situations; (ii) summoning knowledge in the knowledge base; (ii) interacting this knowledge and information; (iv) establishing action strategies; (v) intervening in the problematic situation; (vi) evaluating its results, and (vii) filing the new knowledge in the knowledge base.

It is generally accepted that PCK is constructed by managing the relationship between the knowledge base and the teaching and learning situation to make content knowledge understandable and

teachable for learners [20, 25, 26, 38]. However, some questions emerge regarding how PCK performs each of its different functions and enables the interaction between the knowledge base and the teaching and learning scenario. In Physical Education teaching, declarative knowledge, for example, refers to disciplinary, formal, and informational knowledge, such as that developed by biomechanics, physiology, motor learning theories or human development, and sports training theory [5, 32, 33]. This is what Shulman [21, 23] calls content or subject matter knowledge.

It is precisely this new knowledge that can be taught. Therefore, the future Physical Education teacher begins to demonstrate the improvement of his PCK and his competence to make his knowledge, related to the content, teachable and understandable to his students.

For all the above, the purpose of this study was to design and validate a questionnaire to measure the PCK, in the Physical Education teacher trainee in the context of the practicum.

Materials and Methods

Participants.

146 subjects (n) out of 206 (N) participated, and the study sample was stratified probabilistic [39], with a reliability of 95% ($Z=1.96$), an error of 5%, and a probability (p) of 50%. All were practicum students of the Bachelor's degree program in Physical Education from four Colombian universities, during the first semester of 2022. They were 78.8% male and 21.2% female, with an average age of 25.7 ± 5.2 years. Most of them are located in the ninth semester (37.0%); and they perform their school practice predominantly in the basic primary education cycle (46.6%), followed by basic secondary (29.5%). The project was approved by the bioethics committee of the University of San Buenaventura-Medellin N°14-12-2021. The research was conducted by the Resolution 8430 of 1993 of the Ministry of Health of Colombia [40] and the declaration of Helsinki for research on human beings [41].

Research Design.

A descriptive non-experimental cross-sectional descriptive study was conducted [42]. Initially, content validity was carried out, consisting of a documentary review of studies and publications in specialized databases (Dialnet, EBSCO, Scopus, and Redalyc); from this review, the items of the initial questionnaire were established. Afterward, an expert judgment was carried out to guarantee the quality and adequacy of the items and dimensions [43] with the participation of 10 judges: two Chilean, one Spanish, and seven Colombian, all of them PhDs, teachers, and researchers. Finally, a pilot test of the questionnaire was carried out with 21 practicum students to check the structure of the

survey, and the functionality of the data collection procedures and to identify possible problems with the wording of the items [44]. After the pilot test, no changes were made and the participants were able to complete the questionnaire in approximately 15 minutes.

For the analysis of psychometric properties, the selected students signed the informed consent form, which indicated that participation was voluntary and that they could retire at any time during the study. The students filled out the questionnaire during the internship advisories.

Statistical Analysis.

For the analysis of content validity, the Lawshe model [45] was used, the reference value for a sample of 10 judges and an alpha of .05 was .62 or higher.

The Statistical Package for the Social Sciences (SPSS v.24) was used to perform the analysis. The Kaiser-Meier-Olkin (KMO) sample adequacy statistic (KMO) was applied the reference value to be considered as good was $>.6$ [46]. In Bartlett’s test of sphericity was $p <.05$ [47], to determine the possibility of generating a multidimensional instrument. An exploratory analysis was performed and principal component analysis (PCA) was used as an extraction method, based on a varimax rotation. The internal consistency and reliability analysis was done through Cronbach’s alpha, for each dimension and the questionnaire as a whole ($\alpha >.7$) [48].

Results

In the first stage, 49 articles derived from an exploratory systematic review [48] were reviewed to determine the content validity, from which the initial items (43) were determined and which constituted the structure of the initial questionnaire. This initial version was evaluated by 10 experts on the subject, of the 43 items proposed, 5 of them obtained a score of less than .62 in the Content Validity Ratio (CVR) (Items: 14,15,25,35,37), which is why they were excluded. The other 38 items were rated as necessary, presenting CVR values between .7 and 1.0. The instrument presented a Content Validity Ratio of .92, a result that indicates a very high content validity [49], in other words, there is a high degree of consensus among the judges.

To determine the possibility of proposing a multidimensional instrument, the Kaiser-Meyer-Olkin (KMO) sample adequacy test was applied and its result was .883, which indicates a remarkable fit of the data [50]. Bartlett’s test of sphericity has a significance value of .000, which indicates that a multifactorial analysis can be performed [51].

For construct validity, a principal component analysis (PCA) and varimax rotation were performed, where 8 factors are extracted, however, one item does not charge in any of the dimensions and the other only one in dimension number 8, therefore,

they are removed from the questionnaire. We proceed again to perform the exploratory analysis with the remaining 36 items and at the end, 7 dimensions are proposed that explain a 66.780 of the total variance of the instrument, the result can be observed in Table 1.

Table 1. Factor analysis

Factor	Initial Eigenvalues		
	Total	% of Variance	Cumulated %
1	14.249	39.580	39.580
2	2.456	6.822	46.402
3	1.794	4.983	51.385
4	1.611	4.476	55.861
5	1.272	3.534	59.394
6	1.212	3.368	62.762
7	1.087	3.018	66.780

Regarding the matrix of rotating components (see Table 2), the first factor contains twelve items related to the knowledge and pedagogical application that the teacher in training should have of his or her discipline. Factor 2 groups six items that reference what should be known about the context and everything related to it. Factor 3 loaded three items related to knowledge of assessment (co-assessment, self- assessment, and hetero-assessment). Factor 4 groups five items associated with teaching strategies, especially mentioning games and sports. Factor 5 has five items that refer to the knowledge of students in terms of their characteristics and requirements. Factor 6 has three items that refer to experiential knowledge, from the reflection and dialogue of knowledge that takes place in the practicum. Finally, factor 7 groups three items that refer to the knowledge of procedural, attitudinal, and transversal contents.

When establishing the reliability of the questionnaire it presented a value of .952 in Cronbach’s alpha model, which indicates a very good internal consistency [52]. For each of the dimensions Cronbach’s alpha had a satisfactory rating [53] (see Table 3): pedagogical knowledge of Physical Education ($\alpha=.909$); Knowledge of context ($\alpha=.829$); Knowledge of assessment ($\alpha=.882$); Knowledge of teaching strategies ($\alpha=.848$); Knowledge of students ($\alpha=.825$); Experiential knowledge ($\alpha=.710$); and Content knowledge ($\alpha=.741$). When establishing the relevance of each of the items by eliminating any of them, the value of Cronbach’s alpha does not improve the internal consistency of the total dimension, so the items that compose each of them are preserved.

Table 2. Matrix of rotated components of the factorial analysis

Ítem	M	SD	F1	F2	F3	F4	F5	F6	F7
1	3.507	.7071	.781						
2	3.678	.6207	.683						
3	3.589	.6504	.675						
4	3.445	.7147	.626						
5	3.336	.7815	.623						
6	3.61	.6365	.613						
7	3.507	.9487	.596						
8	3.144	.9321	.59						
9	3.486	.6971	.539						
10	3.425	.7224	.495						
11	3.5	.6873	.494						
12	3.349	.8436	.466						
13	3.384	.7725		.732					
14	3.295	.7805		.725					
15	3.466	.7716		.638					
16	3.377	.7441		.637					
17	3.315	.9667		.606					
18	3.377	.9032		.534					
19	2.986	1.1325			.815				
20	3.116	1.1357			.814				
21	2.932	1.1426			.755				
22	3.219	1.0272				.832			
23	3.418	.8201				.821			
24	3.445	.8224				.664			
25	3.747	.5967				.463			
26	3.281	.869					.737		
27	3.301	.8083					.59		
28	3.384	.8571					.493		
29	3.514	.6771					.434		
30	3.411	.8442					.417		
31	3.26	.9326						.789	
32	3.253	1.0879						.623	
33	3.521	.7068						.442	
34	3.37	.7792							.626
35	3.185	.8789							.531
36	3.116	.8984							.458

Discussion

The purpose of this study was to design and provide initial evidence of the validity and reliability of a tool to identify PCK in the Physical Education (PE) trainee teacher in the context of the practicum. The PCK is of vital importance given that it represents the knowledge that teachers use in the teaching process, distinguishing the teacher of a designated subject from a subject specialist [54].

PE is a subject that is approached very differently from other subjects [55], also in the practicum is where the teacher in training is fully immersed in the reality of the school [56]. As referred to by Kim [19], little research has been conducted to examine how the PCK of trainee teachers of EF develops, therefore it is necessary to unravel those initial levels, which reveal their understanding of the content, the students, and the context before they leave their training programs.

Table 3. Questionnaire reliability statistics (Cronbach’s Alpha)

Dimension	Items	Alpha if the item is removed	Cronbach’s alpha of dimension
Pedagogical knowledge of Physical Education.	1. I consider the interaction between students as an important element in the assessment of the class.	.901	.909
	2. The activities that I implement in the central part of the class are aimed at achieving the purpose of the class.	.898	
	3. I make corrections when actions and/or activities are not properly executed by students.	.900	
	4. I take into account individual-type performance in class assessment.	.903	
	5. I assess the procedures and actions performed by students in the classroom	.899	
	6. I determine actions from less to more complex in the activities I develop in class.	.903	
	7. I approach the concepts of healthy habits and health as an important component of the class.	.911	
	8. I assess or consider at the end of the period, what I found in the input behavior.	.902	
	9. I propose motor actions for students to solve by themselves.	.904	
	10. I provide feedback on the activities and contents worked on in class.	.901	
	11. I use different didactic strategies for the approach of the contents.	.900	
	12. The assessment I perform corresponds to the purposes and contents of the class.	.902	
Knowledge of context	13. I improve my teaching practice by applying elements gathered from Physical Education literature.	.785	.829
	14. I improve my teaching practice by applying elements of pedagogical literature.	.791	
	15. I use the return to calm and rest activities in the didactic approach of the class.	.806	
	16. I consider the differences of the students in the group as a central element when developing the class.	.802	
	17. I consult my advisor about actions I need to implement in my pedagogical practice.	.815	
	18. I consult my cooperator about actions I need to implement in my pedagogical practice.	.813	
Knowledge of assessment	19. I include the co-assessment	.832	.882
	20. I include the self-assessment	.817	
	21. I include the hetero-assessment	.872	
Knowledge of teaching strategies	22. I use sports as part of the content area.	.801	.848
	23. I consider that sport and its different manifestations are a method for approaching the classroom.	.769	
	24. I use leisure, recreation and free time as part of the contents of the area.	.790	
	25. I consider the game to be an important means of approaching the class.	.852	

Table 3 (continued)

Dimension	Items	Alpha if the item is removed	Cronbach's alpha of dimension
	26. I recognize for each level and grade level, the contents that should guide the class.	.749	
	27. I recognize at each level and grade level, the purposes that should guide the class.	.761	
Student knowledge	28. I listen to the recommendations, needs and expectations of the students regarding the class and adapt them based on the possibilities of action according to the planning, purposes and contents according to the grade level.	.819	.825
	29. I plan actions in the area according to the age and characteristics of the students.	.819	
	30. What I address in class is consistent with the comprehensive plan of the Physical Education area.	.790	
Experiential knowledge	31. I dialogue with teachers who are part of the educational institution about actions that can improve my pedagogical practice.	.545	
	32. Dialogue with other practitioners about what develops in the pedagogical practice.	.645	.710
	33. I record and reflect on what I do in class.	.660	
Content knowledge	34. Development of attitudinal contents in the classroom	.589	
	35. Development of conceptual contents within the class.	.696	.741
	36. I approach in a complementary way transversal contents through actions and activities of the class.	.684	
Total questionnaire.952			

This is the first study of this type that investigates the PCK of teachers in training in a Bachelor's degree program in Physical Education in Colombia. This subject has been of great interest, but in subjects such as Biology [57], Physics [58], Mathematics [59], Chemistry [60], among others. Thus, it becomes a study that serves as a starting point to lay the foundations and pave a route toward the improvement of the formative processes and curricular structures of the Bachelor's degree programs in FE.

The starting point for the design was a documentary analysis, which focused on PCK and the review of models such as Gess-Newsome and Carlson [61]; Gess-Newsome and Lederman [62]; Grossman [63], to name a few. However, emphasis was placed on studies that designed and validated instruments that measured the PCK construct in the area of Physical Education, such as that of Almonacid-Fierro et al. [64], which was developed for practicing teachers in Chile, and that of Meier [65] constructed for teachers in training in Germany. Subsequently, the expert panel methodology was used, and their comments from different approaches and perspectives enhanced the instrument [66], also

was important because they pointed out that most of the items constructed are clear, concise, and relevant, which highlights the content validity [65].

The exploratory analysis by the principal components method and varimax rotation this had satisfactory results, as do other instruments in the area [64, 67, 68]. The items loaded on seven factors that account for the PCK construct:

- the first is Pedagogical Knowledge of Physical Education, a component that refers to the teacher's understanding of the subject, of the selection and sequencing of tasks, which he/she can use to teach [69, 70, 71, 72];
- the second is Knowledge of the context, which includes listening to the perceptions of teachers who are more experienced and have been in school longer and the adaptation of an evidence-based practice to the different educational contexts in which they are [30];
- then there is the Knowledge of assessment with a determining characteristic in the formative during the process [73];
- on the other hand there is the Knowledge of teaching strategies, which highlights the ways of making something understandable to others

- [65];
- then the Knowledge of students, which includes knowledge of their developmental characteristics, the characteristics of their culture [30];
- there is also Experiential Knowledge, where the reflection made by the teacher in training is an essential input for the articulation of strategies relevant to the context and becomes a guarantor for the construction of PCK [74];
- and finally, Content Knowledge, refers to how content is developed and presented, it can be seen in the decisions a teacher makes about what and when to teach specific content [75].

Conclusions

The present study provided evidence of the validity and reliability of the questionnaire to assess PCK in Colombian Physical Education students in the practicum. The PCK is a key component in the competence of a teacher and the process of unveiling in terms of a particular field what considerations, competencies, and skills a future teacher should possess to face his or her pedagogical work.

The questionnaire seems to have the potential to identify the knowledge that, about pedagogy, context, assessment, teaching strategies, students,

experiential, and content, a student who is training to be an EF teacher has. Understanding this type of knowledge is a precondition for laying the foundations and paving a path for the improvement of the training processes and curricular structures of the Bachelor's degree programs in PE.

Despite the importance of PCK, in Colombia, the subject is still incipient in the area of PE. Therefore, one of the most relevant aspects of this study is the development of a valid and reliable instrument to evaluate PCK in students in training, specifically in the practicum.

It is important to note that this study is an initial validation of the questionnaire in a group of students, at a certain time and with particular characteristics. Therefore, further studies considering other samples, cultures, and languages are recommended.

Acknowledgement

The authors thank the group of students who participated in this study. No financial support was involved in the research.

Conflict of interest

The authors declare no potential conflicts of interest.

References

1. Dervent F, Ward P, Devrilmez E, Tsuda E. Transfer of Content Development Across Practica in Physical Education Teacher Education. *J Teach Phys Educ*, 2018;37(4):330–9. <https://doi.org/10.1123/jtpe.2017-0150>
2. Fuentes-Abeledo EJ, González-Sanmamed M, Muñoz-Carril PC, Veiga-Rio EJ. Teacher training and learning to teach: an analysis of tasks in the practicum. *Eur J Teach Educ*, 2020;43(3):333–51. <https://doi.org/10.1080/02619768.2020.1748595>
3. Vo KAT, Pang V, Lee KW. Teaching practicum of an English teacher education program in Vietnam: from expectations to reality. *J Nusantara Stud*, 2018;3(2):32. <https://doi.org/10.24200/jonus.vol3iss2pp32-40>
4. Arasomwan DA, Mashiya N. Foundation phase pre-service teachers' experiences of teaching life skills during teaching practice. *South African J Child Educ*, 2021;11(1):1–10. <https://doi.org/10.4102/sajce.v11i1.700>
5. Greve S, Weber KE, Brandes B, Maier J. Development of pre-service teachers' teaching performance in physical education during a long-term internship: Analysis of classroom videos using the Classroom Assessment Scoring System K-3. *Ger J Exerc Sport Res*, 2020;50(3):343–53. <https://doi.org/10.1007/s12662-020-00651-0>
6. Lucero E, Roncancio-Castellanos K. The pedagogical practicum journey towards becoming an english language teacher. *Profile Issues Teach Prof Dev*, 2019;21(1):173–85. <https://doi.org/10.15446/profile.v21n1.71300>
7. Canning R. Reflecting on the reflective practitioner: vocational initial teacher education in Scotland education in Scotland. *J Vocat Educ Train*, 2011;63(4):609–17. <https://doi.org/10.1080/13636820.2011.560391>
8. Flores MA. Practice, theory and research in initial teacher education: international perspectives. *Eur J Teach Educ*, 2017;40(3):287–90. <https://doi.org/10.1080/02619768.2017.1331518>
9. Izadinia M. Student teachers' and mentor teachers' perceptions and expectations of a mentoring relationship: do they match or clash? *Prof Dev Educ*, 2016;42(3):387–402. <https://doi.org/10.1080/19415257.2014.994136>
10. Le Cornu R. *Key components of effective professional experience in initial teacher education in Australia*. Australian Institute for Teaching and School Leadership; 2015.
11. Gess-Newsome J, Taylor JA, Carlson J, Gardner AL, Wilson CD, Stuhlsatz MA. Teacher pedagogical content knowledge, practice, and student achievement. *Int J Sci Educ*, 2019;41(7):944–63. <https://doi.org/10.1080/09500693.2016.1265158>
12. Koh JHL. PACK design scaffolds for supporting teacher pedagogical change. *Educ Technol Res Dev*, 2019;67(3):577–95. <https://doi.org/10.1007/s11423-018-9627-5>
13. Köksal D, Genç G. Learning while teaching: Student teachers' reflections on their teaching

- practicum. *J Lang Linguist Stud*, 2019;15(3):895–913. <https://doi.org/10.17263/jlls.631531>
14. Loughran J. Pedagogical reasoning: the foundation of the professional knowledge of teaching. *Teach Teach Theory Pract*, 2019;25(5):523–35. <https://doi.org/10.1080/13540602.2019.1633294>
 15. White S, Forgasz R. The practicum: The place of experience? In: International handbook of teacher education. Springer; 2016. p. 231–66. https://doi.org/10.1007/978-981-10-0366-0_6
 16. Isse SF, Neto VM. Supervised internship in the training of Physical Education teachers: Scientific publications on the subject. *J Phys Educ*, 2016;27(1):1–15. <https://doi.org/10.4025/jphyseduc.v27i1.2759>
 17. Almonacid Fierro AA, Merellano-Navarro E, Feu Molina S, Vizuete Carrizosa M, Orellana Fernández R. Perspectiva cualitativa en la construcción del conocimiento didáctico del contenido del profesorado de Educación Física [Qualitative perspective in the construction of didactic content knowledge in Physical Education teachers]. *Retos*, 2019;(36):459–68. <https://doi.org/10.47197/retos.v36i36.68840>
 18. Iserbyt P, Ward P, Li W. Effects of improved content knowledge on pedagogical content knowledge and student performance in physical education. *Phys Educ Sport Pedagog*, 2015;22(1):71–88. <https://doi.org/10.1080/17408989.2015.1095868>
 19. Kim I. Preservice teachers' enacted pedagogical content knowledge as a function of content knowledge in teaching elementary physical education content. *Phys Educ Sport Pedagog*, 2020;26(6):649–61. <https://doi.org/10.1080/17408989.2020.1849594>
 20. Ward P, Chen YJ, Higginson K, Xie X. Teaching Rehearsals and Repeated Teaching: Practice-based Physical Education Teacher Education Pedagogies. *J Phys Educ Recreat Danc*, 2018;89(6):20–5. <https://doi.org/10.1080/07303084.2018.1476937>
 21. Shulman LS. Knowledge and teaching: foundations of the new reform. *Harv Educ Rev*, 1987;57(1):1–21. <https://doi.org/10.1177/0017763198571011>
 22. Shulman LS. Research on teaching: a historical and personal perspective. In: The wisdom of practice: essays on teaching learning, and learning to teach. San Francisco: Jossey-Bass; 2004. P. 364–81.
 23. Shulman LS. Those who Understand: Knowledge Growth in Teaching. *J Educ*, 2013;193(3):1–11. <https://doi.org/10.1177/002205741319300302>
 24. Abell SK. Twenty Years Later: Does pedagogical content knowledge remain a useful idea? *Int J Sci Educ*, 2008;30(10):1405–16. <https://doi.org/10.1080/09500690802187041>
 25. Berry A, Depaepe F, Driel J V. Pedagogical content knowledge in teacher education. In: Loughran J, Hamilton ML, editors. *International handbook of teacher education*. Springer; 2016. P. 347–86. https://doi.org/10.1007/978-981-10-0366-0_9
 26. Deng Z. Pedagogical content knowledge reconceived: Bringing curriculum thinking into the conversation on teachers' content knowledge. *Teach Teach Educ*, 2018;72:155–64. <https://doi.org/10.1016/j.tate.2017.11.021>
 27. Kind V, Chan KKH. Resolving the amalgam: connecting pedagogical content knowledge, content knowledge and pedagogical knowledge. *Int J Sci Educ*, 2019;41(7):964–78. <https://doi.org/10.1080/09500693.2019.1584931>
 28. Kleickmann T, Richter D, Kunter M, Jürgen E, Michael B, Krauss S, et al. Teachers' Content Knowledge and Pedagogical Content Knowledge: The Role of Structural Differences in Teacher Education. *J Teach Educ*, 2012;64(1):90–106. <https://doi.org/10.1177/0022487112460398>
 29. Chan KKH, Hume A. Towards a Consensus Model: Literature Review of How Science Teachers' Pedagogical Content Knowledge Is Investigated in Empirical Studies. In: Hume A, Cooper R, Borowski A, editors. *Repositioning pedagogical content knowledge in teachers' knowledge for teaching science*. Springer; 2019. P. 3–76. https://doi.org/10.1007/978-981-13-5898-2_1
 30. Kim I, Ward P, Sinelnikov O, Ko B, Iserbyt P, Li W, et al. The influence of content knowledge on pedagogical content knowledge: An evidence-based practice for physical education. *J Teach Phys Educ*, 2018;37(2):133–43. <https://doi.org/10.1123/jtpe.2017-0168>
 31. Nilsson P. Teaching for understanding: The complex nature of pedagogical content knowledge in pre-service education. *Int J Sci Educ*, 2008;30(10):1281–99. <https://doi.org/10.1080/09500690802186993>
 32. Kahts-Kramer SA, Baard ML. Eastern Cape teachers' perceptions of their pedagogical content knowledge in Physical Education. *African J Phys Act Heal Sci*, 2020;26(Sup1):143–58.
 33. Meier S. Pedagogical content knowledge in students majoring in physical education vs. sport science. The same but different? *Ger J Exerc Sport Res*, 2021;51(3):269–76. <https://doi.org/10.1007/s12662-021-00725-7>
 34. González Sanmamed M, Fuentes Abeledo EJ. El practicum en el aprendizaje de la profesión docente [The practicum in learning the teaching profession]. *Rev Educ*, 2011;(354):47–70.
 35. Parrott JA. *Elementary Physical Education teachers' content knowledge and pedagogical content knowledge of overhand throwing*. Old Dominion University; 2016.
 36. Reuker S. The knowledge-based reasoning of physical education teachers: A comparison between groups with different expertise. *Eur Phys Educ Rev*, 2017;23(1):3–24. <https://doi.org/10.1177/1356336X15624245>
 37. Romar JE, Ferry M. The influence of a methods course in physical education on preservice classroom teachers' acquisition of practical knowledge. *J Teach Phys Educ*, 2020;39(3):374–83. <https://doi.org/10.1123/JTPE.2019-0088>
 38. Aydin S, Demirdogen B, Nur Akin F, Uzuntiryaki-Kondakci E, Tarkin A. The nature

- and development of interaction among components of pedagogical content knowledge in practicum. *Teach Teach Educ*, 2015;46:37–50. <https://doi.org/10.1016/j.tate.2014.10.008>
39. Tryfos P. *Sampling methods for applied research: text and cases*. John Wiley & Sons, Inc.; 1996.
 40. Ministry of Health of Colombia. Resolución número 8430 de 1993. Por la cual se establecen las normas científicas, técnicas y administrativas para la investigación en salud [Resolution number 8430 of 1993. Whereby the scientific, technical and administrative standards for health research are established]. Bogotá: Diario Oficial; 1993.
 41. General Assembly of the World Medical Association. World Medical Association Declaration of Helsinki: ethical principles for medical research involving human subjects. *J Am Coll Dent*, 2014;81(3):14–18.
 42. Thompson CB, Panacek EA. Research study designs: Non-experimental. *Air Med J*, 2007;26(1):18–22. <https://doi.org/10.1016/j.amj.2006.10.003>
 43. Cohen L, Manion L, Morrison K. *Research Methods in Education*. Oxford, UK: Routledge Publishers; 2000.
 44. Bessa C, Hastie P, Rosado A, Mesquita I. Original Article Dispositions for learning in Sport Education Questionnaire - (DFL-SE). *J Phys Educ Sport*, 2022;22(5):1277–88. <https://doi.org/10.7752/jpes.2022.05160>
 45. Wilson FR, Pan W, Schumsky DA. Recalculation of the critical values for Lawshe's content validity ratio. *Meas Eval Couns Dev*, 2012;45(3):197–210. <https://doi.org/10.1177/0748175612440286>
 46. Tabachnick BG, Fidell LS. *Using Multivariate Statistics*. 7^a ed. Pearson; 2019.
 47. Alabdulkarim L. Development and validation of an Arabic pediatric sensorimotor development test. *Int J Pediatr Adolesc Med*, 2022;9(1):36–40. <https://doi.org/10.1016/j.ijpam.2021.03.005>
 48. Cronbach LJ. Coefficient alpha and the internal structure of tests. *Psychometrika*, 1951;16:297–334. <https://doi.org/10.1007/BF02310555>
 49. Newman M, Gough D. Systematic Reviews in Educational Research: Methodology, Perspectives and Application. In: Zawacki-Richter O, Kerres M, Bedenlier S, Bond M, Buntins K, editors. *Systematic Reviews in Educational Research*. Springer Fachmedien Wiesbaden; 2020. P. 3–22.
 50. Divayana DGH, Suyasa PWA, Adiarta A. Content validity determination of the countenance-tri kaya parisudha model evaluation instruments using lawshe's CVR formula. *J Phys Conf Ser*, 2020;1516(1):1–6. <https://doi.org/10.1088/1742-6596/1516/1/012047>
 51. López Berlanga MC, Ortiz Jiménez L, Sánchez Romero C. Construction of Questionnaire-Scale USOTIC "Social Networks in Primary and Secondary School Students: Use and Digital Coexistence." *Educ Sci*, 2022;12:155. <https://doi.org/10.3390/educsci12030155>
 52. Field AP. *Discovering Statistics using IBM SPSS Statistics*. Los Angeles: SAGE; 2018.
 53. Arifin WN. Análisis factorial exploratorio y alfa de Cronbach. *Tenue*, 2017;1(150):1–22.
 54. Bland JM, Altman DG. Statistics notes Cronbach's alpha. *Bmj*, 1997;314(7080):314–572. <https://doi.org/10.1136/bmj.314.7080.572>
 55. Fernandez C. Revisitando a Base De Conhecimentos E O Conhecimento Pedagógico Do Conteúdo (Pck) De Professores De Ciências. *Ens Pesqui em Educ em Ciências*, 2015;17(2):500–28. <https://doi.org/10.1590/1983-21172015170211>
 56. Meier S. An Investigation of the Pedagogical Content Knowledge across German Preservice (Physical Education) Teachers. *Adv Phys Educ*, 2021;11(03):340–52. <https://doi.org/10.4236/ape.2021.113029>
 57. Almonacid-Fierro A, Souza de Carvalho R, Castillo-Retamal F, Almonacid Fierro M. The practicum in times of Covid-19: Knowledge developed by future physical education teachers in virtual modality. *Int J Learn Teach Educ Res*, 2021;20(3):68–83. <https://doi.org/10.26803/ijlter.20.3.5>
 58. Ayala-Villamil LA, Aristizábal Fúquene A. Saberes que movilizan los docentes de biología en el temprano ejercicio profesional [Knowledge mobilized by biology teachers in their early professional practice]. *Rev currículum y Form del Profr*, 2022;26(1):395–415. <https://doi.org/18.30827/profesorado.v26.1.15382>
 59. Melo L, Cardona G, Cañada F, Martínez G. Conocimiento didáctico del contenido sobre el principio de Arquímedes en un programa de formación de profesores de Física en Colombia [Knowledge mobilized by biology teachers in their early professional practice]. *Rev Mex Investig Educ*, 2018;23(76):253–79.
 60. Burbano Pantoja VM, Valdivieso Miranda MA, Busbano Valdivieso AS. El conocimiento didáctico del contenido sobre probabilidad en profesores de matemáticas de la educación básica secundaria colombiana [The didactic knowledge of probability content in mathematics teachers of Colombian secondary basic education]. *Espacios*, 2020;41(37):112–25.
 61. Parga-Lozano DL, Moreno-Torres WF. Conocimiento didáctico del contenido en química orgánica: Estudio de caso de un profesor universitario [Didactic content knowledge in organic chemistry: case study of a university professor]. *Rev Electron Educ*, 2017;21(3):1–21. <https://doi.org/10.15359/ree.21-3.3>
 62. Gess-Newsome J, Carlson J. The PCK summit consensus model and definition of pedagogical content knowledge. *The Symposium Reports from the Pedagogical Content Knowledge*. Nicosia; 2013.
 63. Gess-Newsome J, Lederman N. *Examining Pedagogical Content Knowledge*. Kluwer Academic Publishers; 1999. P.3–17.
 64. Grossman P. *The Making of a Teacher. Teacher Knowledge and Teacher Education*. Teachers College Press; 1990.
 65. Almonacid-Fierro A, Feu S, Vizuete Carrizosa

- M. Validación de un cuestionario para medir el Conocimiento Didáctico del Contenido en el profesorado de Educación Física [Validation of a questionnaire to measure Didactic Content Knowledge in Physical Education teachers]. *Retos*, 2018;(34):132–7. <https://doi.org/10.47197/retos.v0i34.58590>
66. Meier S. Development and validation of a testing instrument to assess pedagogical content knowledge of German preservice physical education teachers. *J Phys Educ Sport*, 2020;20(5):3010–6. <https://doi.org/10.7752/jpes.2020.s5409>
67. Da-Silva C, Saavedra García M, Hortigüela-Alcalá D, Corazza M, Izquierdo González D, Barruso O, et al. Development and validation of a questionnaire to identify the needs detected by the mixed ability rugby environment (Q-NeMAR). *J Phys Educ Sport*, 2022;22(3):811–9. <https://doi.org/10.7752/jpes.2022.03103>
68. González Palacio EV, Chaverra Fernández BE, Bustamante Castaño SA, Toro Suaza CA. Diseño y validación de un cuestionario sobre las concepciones y percepción de los estudiantes sobre la evaluación en Educación Física [Design and validation of a questionnaire on students' conceptions and perception of evaluation in Physical Education]. *Retos*, 2020;(40):317–25. <https://doi.org/10.47197/retos.v1i40.80914>
69. Martínez-Hita FJ, Granero-Gallegos A, Gómez-López M. Diseño y validación de una herramienta para evaluar AICLE en las sesiones de Educación Física [Design and validation of a tool to evaluate CLIL in Physical Education sessions] . *Porta Linguarum*, 2022;(37):193–210. <https://doi.org/10.30827/portalin.vi37.17795>
70. Kim I, Ko B. Developing Elementary Content Knowledge in Physical Education Teacher Education. *Int J Hum Mov Sport Sci*, 2016;4(2):13–9. <https://doi.org/10.13189/saj.2016.040201>
71. Tsuda E, Ward P, Li Y, Higginson K. Content knowledge acquisition in physical education: Evidence from knowing and performing by majors and Nonmajors. *J Teach Phys Educ*, 2021;38(3):221–32. <https://doi.org/10.1123/jtpe.2018-0037>
72. Ward P. The role of content knowledge in conceptions of teaching effectiveness in physical education. *Res Q Exerc Sport*, 2013;84:431–40. <https://doi.org/10.1080/02701367.2013.844045>
73. Ward P, Dervent F, Lee YS, Ko B, Kim I, Tao W. Using Content Maps to Measure Content Development in Physical Education: Validation and Application. *J Teach Phys Educ*, 2017;36(1):20–31. <https://doi.org/10.1123/jtpe.2016-0059>
74. López Pastor VM, Molina Soria M, Arias CP, Manrique Arribas JC. La importancia de utilizar la Evaluación Formativa y Compartida en la Formación Inicial del Profesorado de Educación Física: los Proyectos de Aprendizaje Tutorado como ejemplo de buena práctica [The importance of using Formative and Shared Assessment in Initial Physical Education Teacher Training: Tutorial Learning Projects as an example of good practice]. *Retos*, 2020;37:620–7. <https://doi.org/10.47197/RETOS.V37I37.74193>
75. Amórtegui Cedeño EF, Mosquera JA. La formación de maestros y maestras de ciencias naturales en contextos de aislamiento social: experiencias en la región sur de Colombia [The training of natural science teachers in contexts of social isolation: experiences in the southern region of Colombia]. *Memorias SIFORED - encuentros educación UAN*, 2021.
76. Ward P, Ayvazo S. Pedagogical content knowledge: Conceptions and findings in physical education. *J Teach Phys Educ*, 2016;35(3):194–207. <https://doi.org/10.1123/jtpe.2016-0037>

Information about the authors:

Noelva E. Montoya-Grisales; (Corresponding Author); <https://orcid.org/0000-0003-3267-6999>; noelva.montoya@usbmed.edu.co; Faculty of Education, Universidad de San Buenaventura; Medellín, Colombia.

Alejandro A. Almonacid-Fierro; <https://orcid.org/0000-0002-8328-017X>; aalmonacid@ucm.cl; Faculty of Education, Universidad Católica del Maule; Talca, Chile.

Dora I. Arroyave Giraldo; <https://orcid.org/0000-0003-0913-4841>; dora.arroyave@usbmed.edu.co; Faculty of Education, Universidad de San Buenaventura; Medellín, Colombia.

Karla Valdebenito; <https://orcid.org/0000-0002-7896-6628>; kvaldebenitog@gmail.com; Faculty of Education, Universidad Católica del Maule; Talca, Chile.

Cite this article as:

Montoya-Grisales NE, Almonacid-Fierro A, Arroyave Giraldo DI, Valdebenito González KB. Design and validation of a questionnaire to assess the Pedagogical Content Knowledge of Colombian Physical Education students in the practicum. *Pedagogy of Physical Culture and Sports*, 2022;26(5):300–310. <https://doi.org/10.15561/26649837.2022.0504>

This is an Open Access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited (<http://creativecommons.org/licenses/by/4.0/deed.en>).

Received: 25.08.2022

Accepted: 26.09.2022; Published: 30.10.2022