

THE CONTRIBUTION OF TEACHING PRACTICES ON CONSTRUCTION OF THE PEDAGOGICAL CONTENT KNOWLEDGE OF FUTURE PHYSICAL EDUCATION TEACHERS

LA CONTRIBUCIÓN DE LAS PRÁCTICAS DE ENSEÑANZA EN LA CONSTRUCCIÓN DEL CONOCIMIENTO DIDÁCTICO DE CONTENIDO DE LOS FUTUROS PROFESORES DE EDUCACIÓN FÍSICA

A CONTRIBUIÇÃO DAS PRÁTICAS DE ENSINO NA CONSTRUÇÃO DO CONHECIMENTO DIDÁTICO DE CONTEÚDO DOS FUTUROS PROFESSORES DE EDUCAÇÃO FÍSICA

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ABSTRACT

Purpose: the present study examined how teaching practices fostered PCK knowledge components in future physical education teachers with different levels of training. Methods: participants consisted of four pairs of future teachers with different levels of training in a physical education licensure program. Interview and questionnaire data were collected during 3 academic semesters. The data were qualitatively analysed into units of meaning, which were coded for 4 knowledge components (student knowledge, content knowledge, pedagogical knowledge, and context knowledge). Results: findings indicated that study participants' PCK primarily drew on the student and content knowledge components. Discussion/Conclusion: comparisons between knowledge components and between pairs found that participants' PCK primarily employed the student and content knowledge components and that the pedagogy and context knowledge components of participants' PCK were less well developed.

KEY WORDS: Teaching Practices; Knowledge Base; Pedagogical Knowledge.

RESUMEN

Objetivo: el presente estudio examinó cómo las prácticas de enseñanza adoptaron los componentes pedagógicos del CDC (Conocimiento Didáctico del Contenido) en los futuros docentes de Educación Física con diferentes niveles de entrenamiento. Métodos: el grupo se conformó por cuatro pares de futuros educadores físicos con diferentes niveles de entrenamiento. Las entrevistas y datos de los cuestionarios fueron obtenidos durante tres semestres académicos. Los datos fueron analizados cualitativamente y agrupados en cuatro componentes de conocimiento (conocimiento de los estudiantes, conocimiento del contenido, conocimiento pedagógico y el conocimiento contextual). Resultados: los hallazgos del estudio indicaron que los participantes enfatizaron principalmente en los componentes de conocimiento de los estudiantes y conocimiento del contenido. Discusión/ Conclusión: las comparaciones entre los componentes del conocimiento en las parejas de estudiantes de Educación Física mostraron que los componentes más usados por los participantes del CDC fueron: el conocimiento de los estudiantes y los contenidos del conocimiento; mientras que el conocimiento pedagógico y el conocimiento contextual fueron los menos desarrollados.

PALABRAS CLAVE: Prácticas De Enseñanza, Bases Del Conocimiento, Conocimiento Pedagógico.

RESUMO

Objetivo: o presente estudo examina como as práticas de ensino fomentam o conhecimento didático de conteúdo (PCK) nos futuros professores de Educação Física com diferentes níveis de formação. Métodos: foram realizados trabalhos em conjunto com quatro pares de futuros professores com diferentes níveis de formação em um programa de licenciatura em Educação Física. Foram recopilados dados com entrevistas e questionários durante três semestres acadêmicos. Os dados foram analisados qualitativamente em unidades de significado, codificadas por 4 componentes de conhecimento (conhecimento dos estudantes, conhecimento do conteúdo, conhecimento pedagógico, e conhecimento contextual). Resultados: os resultados indicaram que os participantes do estudo PCK delimitaram nos estudantes os componentes do conhecimento didático. Discussão/Conclusões: a comparação entre os componentes do conhecimento e entre os pares estabelecem que os participantes de PCK, principalmente, utilizaram os estudantes e os componentes do conteúdo de conhecimento; e que a pedagogia e o contexto dos componentes de conhecimento dos participantes do PCK foram menos desenvolvidos.

PALAVRAS CHAVLE: Práticas De Ensino, Conhecimento De Base, Conhecimento Pedagógico.

INTRODUCTION

The pedagogical knowledge base, which has been termed pedagogical content knowledge (PCK), incorporates knowledge regarding students, subject matter content, general pedagogy, educational contexts and integrates these knowledge base components with teaching practice (Cochran, King, & DeRuiter, 1991; Grossman, 1990; Grossman, Wilson, & Shulman, 1989; Shulman, 1987).

The student knowledge component is fundamental because instructors must understand and consider their students' characteristics, interests, and needs as well as differences in students' ideas, beliefs, experiences, and knowledge in teaching and learning contexts (Chen, 2004; Darling-Hammond, 2006; Gess-Newsome, 1999; Graça, 1997; Park, Jang, Chen, & Jung, 2010; Park & Oliver, 2008; 2008; Rovegno & Dolly, 2006; Schincariol, 2002; Whipple, 2002). Future teachers must not only possess content knowledge (CK) but also be able to adapt this knowledge to make it accessible to students (Ayvazo, Ward, & Stuhr, 2010; Grossman, et al., 1989; Marks, 1991; Schempp, Manross, Tan, & Fincher, 1998; Schincariol, 2002; Segall, 2004; Siedentop, 2002a; Tinning, 2002).

The pedagogical knowledge (PK) is recognized to develop teaching concepts and educational principles, identify pedagogical strategies, and plan, organise, and create teaching and learning activities (Behets & Vergauwen, 2006; Grossman, 2008; Morine-Dershimer & Kent, 1999; O' Sullivan & Doutis, 1994; Rovegno, 2008; Schincariol, 2002; Seel, 1999; Whipple, 2002). Context knowledge (CX) enables instructors to understand school and classroom organisation and management; the communities in which the students live; and governmental, institutional, and political dimensions that influence the educational system (Grossman, 2008; Grossman & McDonald, 2008; Menck, 1995; O' Sullivan & Doutis, 1994; Rovegno, 1994, 1995, 2006, 2008; Rovegno & Dolly, 2006; Schincariol, 2002; Sieden-

top, 2002b; Veal & MaKinster, 1999; Whipple, 2002; Wiegand, Bulger, & Mohr, 2004; Zeichner, 1993, 2010).

For Cochran et al. (1991), PCK plays a central role in teachers' professional knowledge because it is based on and integrates the above knowledge base components (SK, CK, PK and CX). Therefore, teachers use PCK according to their objectives, the reality of the students, and characteristics of the teaching and learning context. This knowledge allows teachers to summon, manage and integrate the components of their knowledge base for teaching to adapt, transform and implement the content knowledge in a comprehensible and teachable way (Shulman, 1987; Marcon, Graça, & Nascimento, 2011). Cochran et al. (1993) proposed a model to represent the evolution of PCK during training, which they termed pedagogical content knowing (PCKg), and identified the importance of each PCK knowledge component, based on future teachers' levels of teaching experience (see Figure 1).

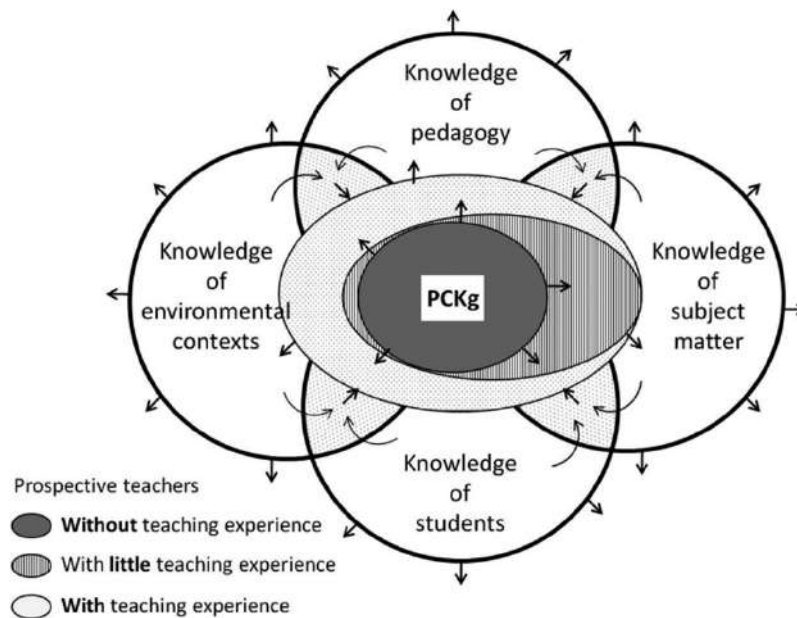


Figure 1. A Developmental Model of Pedagogical Content Knowing (PCKg) as a Framework for Teacher Preparation (adapted from Cochran, DeRuiter, and King, 1993)

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The evolution of teaching experience during teachers training allows future teachers' PCK to expand from a limited knowledge base with a single knowledge component into a knowledge base with 4 integrated components that collectively contribute to teaching expertise (Cochran, et al., 1991; Grossman, 1990; Whipple, 2002; Wiegand, et al., 2004). The four types of knowledge are transformed and synthesized as PCK, and theoretically, the four components become so integrated and so interrelated that they no longer can be considered separate knowledge. These integration processes should result in conceptual change and conceptual integration to the point that the resulting PCK knowledge, the expertise of teaching, is distinctively different from types of knowledge from which it was constructed (Cochran, et al., 1991, p. 12). However, there is no evidences showing the progress of PCK's acquisition during teachers' training. In general, beginners' PCK is basic and incomplete, which is represented in Figure 1 by the small and centred dark shading, while graduates have more complex and elaborated PCK, which is represented by the lighter and more extended shading (Cochran et al., 1993).

Because previous research did not explain the development of PCK during teacher education programs or how training programs foster PCK construction, the purpose of this study was to investigate how future teachers' PCK was constructed during physical education teacher training and the extent to which future physical education teachers employed the various knowledge base components during the construction of PCK.

METHOD

Research design

The present study was a qualitative case study, and data were collected over 3 semesters (Dentin & Lincoln, 2005; Thomas, Nelson, & Silverman, 2011; Yin, 2009).

Participants and setting

Study participants were prospective teachers enrolled in a 4-year physical education licensure programme from a higher education institution (HEI) in the Brazilian State of Rio Grande do Sul. The institution has more than 30 years of experience in training physical education teachers and provides future teachers with a broad range of field experiences and pedagogical training. Participation in the study was voluntary, and signed consent forms explicitly stating that participation was voluntary and confidential were obtained from each participant.

Four pairs of participants were invited to participate in the research. Each pair had a different level of training in the licensure program. One pair (P1) was assessed during their first quarter in the program; one pair (P2) was assessed during their second quarter in the program; one pair (P3) was assessed during their third quarter in the program; and one pair (P4) was assessed during their final quarter in the programme. Participants met the following inclusion criteria: females between the ages of 18 and 22 who had completed secondary public school education; individuals with higher academic marks and more course credits compared to other students with the same level of training; individuals with more sports experience, which was measured by years and levels of practice (local, national, or international); and individuals with more teaching experience (working as an independent or assistant instructor in a public or private educational institution; working at a sports, recreational, or social club; or working at a resort, hotel, or similar establishment).

Data collection

Data were collected through interviews conducted by the first author at the beginning and end of the 3-semester observation period; structured logs reporting reflections on field experiences; and informal interviews. The initial interview framework was based on the theoretical foundations of the PCK knowledge base for

teaching (Cochran, et al., 1993; Cochran, et al., 1991; Grossman, 1990; Shulman, 1986, 1987), the participants' field experiences, and the teaching practice exercises (Park & Oliver, 2008; Tsangaridou & O' Sullivan, 1994; Valli & Rennert-Ariev, 2002).

The first interview was semi-structured and included open-ended questions that obtained biographical information and assessed how each prospective teacher expected to employ SK, CK, PK and CX during the teaching practice activities. 10 hours and 56 minutes of interviews were transcribed. The documents were sent to the participants for confirmation and comment.

The second instrument for data collection was a structured log. The log included both open-ended and closed questions that prompted participants to identify the knowledge components they applied in their teaching practices. Prospective teachers recorded their thoughts, actions, and reflections after each teaching experience, such as peer teaching at the university or student teaching at the classroom and hand-delivered or emailed their logs to the first author every two weeks during the data collection period. Periodically, email or face-to-face informal interviews were also conducted to obtain further information regarding participants' use of the different knowledge components. This strategy was implemented during the students' field experiences in order to adjust the research instrument and to encourage participants to reflect more deeply on their experiences.

The design of final interview was based on data collected from other sources adopting an approach from O' Sullivan and Tsangaridou (1992). The semi-structured interview included open-ended and closed-ended questions to inquiry the extent to which participants employing SK, CK, PK, and CX during their experiences, processes, outcomes, and concerns, and the resources that participants felt they needed to face the challenges of the teaching practice activities. Seven hours and 33 minutes of interviews were transcribed. The transcriptions were sent to the participants for confirmation and comment.

Data analysis and reliability

The interviews were transcribed verbatim, and the written content provided by the structured logs was coded and analysed using a qualitative content analysis (Schrier, 2012). The software QSR NVivo 8 was used to the categorization process. Initially the data were analysed as a deductive process. All quotes that referred to a knowledge component of any type were identified and further analysed into meaning units, which were then coded as the SK, CK, PK and CX components based on the framework developed by Cochran et al. (1991), Grossman (1990), Grossman et al. (1989), and Shulman (1987). After this process, an inductive process was performed. The data was broken into meaning units to identify participants' perspectives and underlying messages. This process of de-contextualisation and re-contextualisation involved identifying and interpreting the messages within the "text" as well as the personal and pedagogical context in which the text was produced. Second, the text files were parsed into meaning units and coded into categories. Finally, the triangulation process identified new meanings and patterns based on multiple comparisons across data sources, across and within participant pairs, and across categories (Denzin & Lincoln, 2005; Thomas, et al., 2011; Yin, 2009). In order to obtain the objectivity reference for each of the categories (SK, CK, PK and CX) descriptive statistics (frequencies, ratio, percentages) was used to organize the data.

The data collection and analysis procedures were based on the theoretical PCK component framework, and used specific procedures to enhance data reliability: reviewing transcripts, triangulating data sources, and actively searching for disconfirming information to prevent biased interpretations and unwarranted conclusions.

Results and discussion

The number and type of teaching practices that prospective teachers engaged during the 3-semester data collection period

depended of the number and the natures of the courses. Table 1 summarises the characteristics of the teaching activities that participants engaged in during the 3-semester data collection period (participant names are fictitious).

Pairs	Prospective teachers	Curricular	Extra-curricular	Total	%
P1 (up to 25% of the program)		17	2	19	8,05
	Aline	11	0	11	4,66
	Amanda	6	2	8	3,39
P2 (25 – 50% of the program)		30	45	75	31,78
	Bárbara	20	36	56	23,73
	Bianca	10	9	19	8,05
P3 (50 – 75% of the program)		26	32	58	24,57
	Camila	22	3	25	10,59
	Carina	4	29	33	13,98
P4 (> 75% of the program)		84	0	84	35,60
	Daiana	50	0	50	21,19
	Dalila	34	0	34	14,41
Teaching practices analyzed		157	79	236	100,00

Table 1: Frequency of teaching practices occurrences by participants

The participant pairs engaged in different curricular pedagogical activities. Most of P1's teaching activities involved some form of peer teaching, with only a few activities involving teaching community students at the campus; P2 engaged in less peer teaching and more teaching involving community students at the campus; P3 had fewer teaching activities involving community students at the campus and more elementary school teach-

ing (early field experiences and student teaching); and P4 activities exclusively involved elementary school student teaching.

P4 only pursued student teaching activities and did not engage in any extracurricular activities. P1 also seldom engaged in extracurricular activities. The high number of extracurricular activities in P2 and P3 was due to the extracurricular activities that Barbara and Carina engaged in. Barbara had more than five years of experience instructing and training swim teams. Carina's numerous extracurricular teaching practices were not specialised but were distributed among various sports.

Table 2 presents information on the frequency and rate of knowledge references to SK, CK, PK and CX in the different teaching practices.

Pairs	P1	P2	P3	P4	Total
Teaching practices analyzed (TP)	19	75	58	84	236
Student knowledge (SK)	34	76	56	54	220
Content knowledge (CK)	12	38	19	52	121
Pedagogical knowledge (PK)	13	41	51	41	146
Context knowledge (CX)	10	29	38	31	108
SK/TP ratio	1,79	1,01	0,97	0,64	0,93
CK/TP ratio	0,63	0,51	0,33	0,62	0,51
PK/TP ratio	0,68	0,55	0,88	0,49	0,62
CX/TP ratio	0,53	0,39	0,66	0,37	0,46

Table 2. Ratio of references in the categories of knowledge base for teaching per teaching practices for pairs of prospective teachers in distinct stages of licensure process

Compared to the content, pedagogical, and context knowledge components, the student knowledge (represented by the

SK/TP ratio) in overall was the most component referred. The pedagogical knowledge component (the PK/TP ratio) ranked second in overall frequency. P1 and P4 most often referred to this component in their logs; in contrast, P3 made the fewest references to this component. Content knowledge (the CK/TP ratio) ranked third in overall frequency. P3 referred to this knowledge component most often, and P4 made the fewest references to this component. Finally, the context knowledge component (CX/TP ratio) was least frequently reported in participants' logs. P3 referred to this knowledge component most often, and P4 made the fewest references to this component. P2 also seldom referred to this knowledge component.

Because the student knowledge component was the PCK component most frequently mentioned, it was the component that most concerned participants engaged in pedagogical practices. Participants most often focused on the student knowledge component regardless of their level of training (Park et al., 2010; de Veal & Makinster, 1999). The literature suggests that participants might focus on the student knowledge component based on participants' own (admittedly limited) personal experiences as elementary and secondary students (Behets & Vergauwen, 2006; Grossman, et al., 1989).

The frequency of reference to the student knowledge component, primarily for P1 and P2, contrasts with the development of the PCK proposed by Cochran et al. (1993). The present study found that participants did not initially focus on the content knowledge component as Cochran et al. (1993) proposed but primarily focused on the student knowledge component. Moreover, despite a noticeable decrease in the frequency of reference to the student knowledge component, this knowledge component continued to be the most frequently referred to compared to the other knowledge components for P3 and P4. Consequently, the student knowledge component of the PCK continued to predominate for P3 and P4. This finding conflicts

with Cochran et al.'s (1993) claims but is consistent with Park et al. (2010) and de Veal and Makinster (1999).

The finding that the student knowledge component was employed most frequently is consistent with the view that future teachers must carefully consider their students' knowledge, conceptions, characteristics, interests and needs to plan, create, and manage their teaching practices: *"The students was engaged in the class"* (Aline); *"The students had not been paying attention in the activities"* (Bianca); *"the students were lazy in the class"* (Carina).

The participants' preference for employing the student knowledge component of the PCK is thus consistent with claims found in the literature (Cochran, et al., 1991; Grossman, 1990; Jenkins & Veal, 2002; Park, et al., 2010; Veal & MaKinster, 1999). However, under an alternative interpretation, this finding does not reflect participants' concern for their students' prior knowledge, notions, characteristics, interests and needs or a concern for student learning and education, as claimed in the literature (Cochran, et al., 1991; Grossman, 1990; Jenkins & Veal, 2002; Park, et al., 2010; Rovegno & Dolly, 2006; Veal & MaKinster, 1999). Rather, qualitative analysis of the content of participants' reflections revealed that they were primarily concerned with themselves, with the success of their performance as teachers, and with the fulfilment of their plans, which sometimes involved the desire to avoid embarrassing, conflicting, and challenging situations with students:

I'm still having difficulty to "control" some students with regard to their attitudes [...]. I need to be more energetic with them, demonstrating more firmly against the wrong attitudes that they do [...]. Some students [verbally attack] each other and not far follow the teacher's instructions [...] (Camila)

A third interpretation of this finding is based on the related finding that the frequency of references to the student knowledge component of the PCK gradually decreased as participants advanced in the program. This decrease suggested that P4 achieved

one of the teacher training objectives because their PCK expanded to include all components. In contrast to P1's PCK, which focused on the student knowledge component and reflected their beginning level of training, P4's PCK also focused on the content, pedagogical and context knowledge components:

"The learning progress has been evident and the students are getting the message that the class with rules is going much better." (Daiana). "I can not require more than students can develop [...]. I believe I have made very difficult activities for the age group"(Dalila).

P4 exhibited the fewest differences in the frequency of reference to the different PCK knowledge components. This finding is consistent with claims in the literature (Cochran, et al. 1993; Jenkins & Veal, 2002; Veal & MaKinster, 1999) regarding the rates of reference to PCK components by future teachers toward the end of their training, which is represented by the lighter, more symmetric and extended shading in Figure 1. However, based on study findings, the shading representing P4's PCK would fall on student and content knowledge rather than over the base as Cochran et al. (1993) proposed.

The decrease in the frequency of references to student knowledge was associated with decreases in the frequency of references to pedagogical and context knowledge, although this decline was less pronounced and more variable. However, references to the content knowledge component did not decline in frequency; both beginners and graduates frequently referred to this component. The literature (Ayvazo, et al., 2010; Cochran, et al., 1991; Grossman, 1990; Marks, 1991; Park & Oliver, 2008; Schempp, et al., 1998; Segall, 2004; Siedentop, 2002a; Tinning, 2002) has stressed the role of the content knowledge component because in addition to establishing the understanding of the subject matter, content knowledge is indispensable for the satisfactory development of the PCK as a whole.

The model of Cochran et al. (1993) claims that future teachers with little teaching experience focus primarily on the subject matter—PCK content knowledge. In part, study results support this claim due to the frequency of reference to the content knowledge component, which participants with more advanced levels of training continued to employ. However, PCK content knowledge was not fully utilised because participants were limited in their ability to adapt the content of the teaching material from a pedagogical perspective. This limitation revealed that participants focused on the need to master the subject matter, which interfered with their ability to adapt teaching materials to students' knowledge level, concepts, characteristics, interests, and needs:

“The class today was better than previous due to my knowledge of the conten.”(Aline). “As I have not much experience with the subject of the lesson, I do not practice, I do not know much about it the class might not be very good.” (Bianca).

Consistent with findings reported in the literature (Graça, 1997; Marks, 1990; Mitchell, Doolittle, & Schwager, 2005; Schempp, et al., 1998; Schincariol, 2002; Siedentop, 2002a), study findings indicated that the more participants mastered the subject matter in terms of their own sport, the more their teaching improved. Furthermore, the less information participants had in regard to their students' knowledge, concepts, characteristics, interests, and needs, the greater the importance they attached to increasing their content knowledge. McCaughtry and Rovegno (2003) and Whipple (2002) also noted that the content knowledge of future physical education teachers provided significant support for planning and implementing teaching and learning practices, in addition to serving as a source of personal security and comfort.

The results of this study demonstrated the value attributed to the content knowledge component by participants, which is consistent with the literature, training programs, and the views of teacher-trainers. Although the literature reports that the PCK content knowledge

component is the most frequently employed component (Cochran, et al. 1991; Jenkins & Veal, 2002; Marks, 1991; Veal & MaKinster, 1999), this PCK component was the third most frequently employed in the pedagogical practices analysed in the study due to difficulties experienced by P3. Because one member of this pair, Camila, encountered problems due to students' lack of discipline and poor behaviour, she primarily sought PCK context knowledge as well as pedagogical knowledge to resolve problem situations, which resulted in fewer references to content knowledge.

With the exception of P3, who faced students' lack of discipline and poor behaviour, rates of reference to PCK pedagogical and context knowledge tended to decline from P1 to P4. Individuals beginning the training program referred proportionately more often to pedagogical and contextual issues in teaching physical education in comparison to graduates.

Beginners typically focused on problem situations in their pedagogical activities. Due to their desire to resolve problem situations, it was natural for beginners' PCK to continually draw on the same knowledge base component; this behaviour distinguished their PCK use from graduates' pattern of PCK use.

Thus, beginners' use of PCK did not draw equally on all knowledge base components. At the same time, because their knowledge base components were relatively new and unstructured, their PCK did not allow them to integrate information from the knowledge base components with their teaching practices. Consequently, beginners' PCK was unlikely to fulfil its primary role of transforming content knowledge into material that was comprehensible and accessible to students.

Graduates more frequently utilised the pedagogical and context knowledge components, both in comparison to the beginners and to their own use of other knowledge base components:

"I'm analysing the situations that happen and relating with my prior knowledge [...] The experiences I gained during the semester were

very helpful to class today” (Daiana). “I learned a lot on the implementation of futsal skills. I cannot request more than students can develop” (Dalila).

Despite they less frequently utilised pedagogical and context knowledge components, the reason is not because they ignored these components, but because graduates drew equally from all PCK knowledge base components. This finding is consistent with Veal and Makinster (1999) and Whipple (2002) as well as the Cochran et al. (1993) model, as illustrated in the lighter, extended, and centred shading in Figure 1.

It is important to note that the development of the participants’ PCK and differences in participants’ level of training were not associated with more frequent use of PCK components. This finding conflicts with claims of the Cochran et al. (1993) model, which is represented in Figure 1 by the expansion of the shading of the PCK to more experienced future teachers. Rather than increasing the overall frequency of PCK components, study findings are consistent with the claim that as future teachers become more experienced, their PCK improves because information in each PCK component becomes more comprehensive, consistent, and available (Cochran et al., 1993).

Although graduates made fewer references to all PCK components in comparison to students beginning training, the critical thinking and discernment of their reflections indicated that the decrease in the frequency of references was due to the increased quality of the information drawn from the PCK components. Similarly, the decreased frequency observed for graduates was based on their ability to use their PCK to identify and prioritise problems and precisely and directly employ their knowledge to identify the pedagogical practices that would meet the demands of the situation:

“Based on the experience I have gained during the classes, I’m getting work around the situation of the students’ behaviour [...] I

have a lot to improve on my teaching practices, but I can say that the reason of my classes are going better is due to the knowledge and experience I'm getting over the training" (Daiana).

The finding that graduates' PCK was distinguished by the quality of the information they employed rather than the frequency with which they drew on the information is consistent with the constructivist claims of Cochran et al. (1993), which is illustrated by the lighter, extended, and centred shading in Figure 1.

Another important aspect that should be noted is the parallel between the concepts of pedagogical knowledge and context knowledge among the theoretical approaches. The literature suggests that future teachers construct these 2 types of knowledge in 3 different ways: the *micro* approach, in which classroom management and direct relationships with students enable instructors to identify and evaluate students' concepts, beliefs, characteristics, interests and needs; the *meso* approach, in which the school environment, pedagogical design, curricular disciplines, and relationships with other teachers are integrated and used to achieve the educational objectives and student learning; and the *macro* approach, which is based on identifying how the educational, cultural, social, and economic realities facing students, families, neighbourhoods and communities affect the teaching and learning process (Behets & Vergauwen, 2006; Grossman, 2008; Grossman & McDonald, 2008; Menck, 1995; Morine-Dershimer & Kent, 1999; O' Sullivan & Doutis, 1994; Rovegno, 2006, 2008; Rovegno & Dolly, 2006; Schincariol, 2002; Seel, 1999; Siedentop, 2002b; Veal & MaKinster, 1999; Wiegand, et al., 2004; Zeichner, 2010).

The study findings indicated students concerned to in achieve their immediate objectives, to put their class plans into effect, to apply various strategies, and to reflect on programme content:

I could make them understand what I was teaching, and they made inquiries about the rules [...], they really tried to understand the game (Aline). Although some activities have not occurred according to the lesson plan, I can say that at the end, the proposed objective was fulfilled: passing, receiving, dribbling and shooting (Camila).

The participants didn't show concerns related to the continuity of the teaching and learning process, or the extent to which students' school and life context directly influenced their knowledge, ideas, and learning. Similarly, Zeichner (1993) noted that "as there is a tendency to work with one teacher each time in an isolated class", future teachers regard teaching as a "solitary activity" and "in the classrooms, it is as if the rest of the school didn't exist" (p. 59). For this reason, Zeichner declares that teacher training rarely contemplated perspectives "beyond the domain of the classroom, with the goal of including a special notion that the school is a community" (Zeichner, 1993, p. 60).

Participants thus seemed to regard student learning as occurring vertically and in a cumulative manner; once content is presented, students completely and immediately assimilate it without any need for further interpretations, ideas or knowledge. Participants appeared to believe that the same pedagogical practice could be administered under any circumstances, at any time, and to any student without consideration of the student's prior knowledge and concepts.

These findings indicated that participants felt the need to defend and protect themselves from the adverse situations that they might encounter in their pedagogical practices and justified the consequences based on student and content knowledge.

The study analysis also suggested that although participants were more concerned with knowing their students, the literature and teacher-trainers primarily focus on future teachers' content knowledge. Consequently, pedagogical knowledge and context knowledge are at the margins during the teacher training

process and are only sporadically referred to during training programs in regard to specific strategies, certain pedagogical practices and particular curricular stages (Abell et al., 2009; de Van Driel, Veal, & Janssen, 2001).

Although study participants seldom considered context knowledge, this knowledge component is fundamental in future physical education teachers' training. Context knowledge underlies the consolidation of the PCK because it provides a framework for integrating the other knowledge base components. From this perspective, context knowledge is the means through which the training programme elaborates the knowledge base components and constructs future physical education teachers' PCK.

CONCLUSION

The present study led to the following conclusions regarding the development of future physical education teachers PCK during their training. Beginners' PCK limited their ability to filter, identify, and assimilate diverse information from teaching and learning situations, which created difficulties in identifying the appropriate knowledge component to employ. Because they had not yet mastered the content knowledge of their field of study, these participants relied on their tacit knowledge and experiences as elementary or secondary students. Consequently, beginners most often drew on the PCK student knowledge component.

In contrast, graduates' PCK was more critical and selective, which allowed them to focus on the problem situations that required attention and to solve these problems by identifying the appropriate knowledge base component. For graduates, prior experience, training, and extracurricular activities improved the structure and availability of information for all PCK knowledge base components.

It should be noted that participants frequently drew on the PCK student knowledge component regardless of their level of training. However, rather than considering students' knowledge, concepts, characteristics, interests, and needs in the planning and managing of pedagogical practices, participants sought this information to ensure that their knowledge of the subject matter would be greater than that of their students.

Although participants drew on the student knowledge component more frequently, they also employed the content knowledge component in their teaching practices. However, they were less concerned with student learning and more focused on their own knowledge of the subject matter.

Participants were least likely to use the PCK pedagogical and context knowledge components in planning, implementing or managing their teaching activities. In addition, use of these two knowledge components was independent of their level of training. Participants exhibited difficulty in extending pedagogical and context knowledge beyond a single pedagogical activity or the limits of the classroom. Participants focused on their own concerns and on teaching their classes as planned, rather than with the teaching and learning process and the construction of new knowledge by the students over time. In other words, participants did not transcend their abstract preconceived scenarios to consider the broader educational implications of their activities.

Therefore, we found that initially, beginning students' PCK was deficient in regard to pedagogical and context knowledge. Consequently, beginners' PCK did not allow them to make content knowledge understandable and accessible to their students; this objective was only achieved at the end of the training. This finding conflicted with claims in the literature, which stress the importance of the elaboration and strengthening of all components of the PCK knowledge base.

In summary, future physical education teachers will only be able to reflect on and apply PCK knowledge base components

to teaching if diverse strategies are developed during training that allow them to approach, question, and interact with their students' educational and life contexts. These strategies should address the different types of pedagogical practices that are planned and administered to peers and school-age students and conducted in the institution's education department and schools of basic education.

Finally, professional teacher-trainers must establish training mechanisms to stimulate future teachers' reflection, sensitivity, and critical thinking in regard to each knowledge base component, whether the focus is the planning, implementation or management of pedagogical practices, interaction with students, student learning, or the construction of teachers' PCK.

Thus, the teacher-training process should address all knowledge base components. Judicious and careful follow-up by teacher-trainers and critical analysis and reflection by future teachers will ensure that future physical education teachers' construction of PCK during their training is satisfactory.

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