



PEDAGOGICAL CONTENT KNOWLEDGE IN CO-TEACHING FOR SPECIAL EDUCATORS

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More than three decades ago, Shulman introduced the concept of Pedagogical Content Knowledge (PCK) to describe the ways of representing and formulating the subject matter to make it comprehensible to others. It involves understanding of how particular subject matter topics and issues are organized and represented in order to teach in an effective way. It also involves understanding the needs and struggles of the students. Shulman (1987) identified PCK as one of seven categories of teachers' knowledge which is essential for providing meaningful learning experiences to all students including children with disabilities. This calls for special educators in inclusive settings to possess the knowledge and skills to implement PCK in teaching all students. There is no global PCK model; researchers have explained it differently in terms of components in the field. This paper attempts to explain the concept of PCK, its importance for special educators teaching in co-teaching and two models of PCK namely Shulman's Model and Ball's Model.

KEYWORDS: Pedagogical Content Knowledge, Special Educators, Co-Teaching

INTRODUCTION

Over years, special education has evolved. In the past, students with disabilities were completely isolated. From there they moved to specialized classrooms and then to segregated hallways or buildings away from the general education curriculum. Eventually the model changed to one that included children with disabilities in the general education classroom. For this to happen, practitioners, proponents, parents and researchers have made compelling arguments advocating for inclusion for people with disabilities in

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education (Lipsky & Gartner, 1997; Walther-Thomas, Korinek, McLaughlin, & Williams, 2000).

The last few decades have seen an increase in the diversity of the student population in schools and classrooms, and these diverse populations include students with disabilities (Mastropieri et al., 2005), which calls for collaboration among professionals. Most professionals believe that for effective inclusion, effective and continuing collaboration among stakeholders is essential (Walther-Thomas et al., 2000). In the process of creating successful inclusive classrooms, collaboration between general and special education teachers is particularly important and has gained attention in the field (McLaughlin, 2002). Thousand, Villa, and Nevin (2006) explained that collaboration in regular education curriculum involves four different personnel support options and co-teaching is one of them. Co-teaching is an instructional partnership between two or more people in all aspects of teaching in a classroom.

Literature highlights that the dependence of effective co-teaching partnerships on the content knowledge of special education teachers and about highly qualified special educators (Keefe, Moore, & Duff, 2004; Mastropieri et al., 2005), there is not much literature about special education teachers' contributions in terms of examples used or implemented a specific strategy in a co-teaching team within the framework of PCK and take a lead teaching role in co-teaching (Tandon, 2013). For a special education teacher to effectively teach a concept and make connections among concepts and processes in the core content area, requires the knowledge of PCK.

PEDAGOGICAL CONTENT KNOWLEDGE (PCK)

In 1986, Shulman introduced the term Pedagogical Content Knowledge (PCK) and explained that PCK is the teacher's understandings of how students comprehend the specific subject matter. Tracing the history of content and pedagogy in academia, Shulman (1986) says that there always has been a "sharp distinction" between the two, that a professional possesses expertise in either content or pedagogies and is not accountable for the other. He believes that this distinction is newly constructed, that a century ago the "Defining characteristics of pedagogical accomplishment was knowledge of content" (p. 7). Shulman and his colleagues (1986) introduced the term Pedagogical Content Knowledge (PCK) while conceptualizing the significance of the professional knowledge base needed for effective teaching. He explained that PCK is teachers' understanding of how students comprehend the specific subject matter. PCK is concerned with the ways of representing and formulating subject matter that make it comprehensible to others. Shulman defined PCK as:

The most useful forms of representation of those ideas, the most powerful analogies, illustrations, examples, explanations, and demonstrations – in a word, the ways of representing and formulating the subject that makes it comprehensible to others. Since there are no single most powerful forms of representation, the teacher must have at hand a veritable armamentarium of alternative forms of representation, some of which derive from research whereas others originate in the wisdom of practice (p. 9).

PCK includes a wide array of teaching strategies ranging from examples to analogies to demonstrations, which a teacher acquires as a result of the teaching experience and from research. Further expanding on Shulman's definition, [Magnusson, Krajcik, and Borko \(1999\)](#) defined PCK:

Pedagogical content knowledge is a teacher's understanding of how to help students understand specific subject matter. It includes knowledge of how particular subject matter topic, problem, and issues can be organized, represented and adapted to the diverse interest and abilities of learners, and then presented for instruction, the defining feature of pedagogical content knowledge is its conceptualization as the results of a transformation of knowledge from another domain (p. 96).

Knowledge of content and of the needs and struggles of students are two other essentials of PCK that help a teacher choose an appropriate strategy for teaching a specific concept within a particular core content area. Differentiating between pedagogical content knowledge and that of a content specialist such as a scientist, [Cochran, King, and Deruiter \(1991\)](#) defined PCK:

Teachers differ from biologists, historians, writers, or educational researchers, not necessarily in the quality or quantity of their subject matter knowledge, but in how that knowledge is organized and used. For example, for experienced science teachers, knowledge of science is structured from a teaching perspective and is used as a basis for helping students to understand specific concepts. A scientist's knowledge, on the other hand, is structured from a research perspective and is used as a basis for the construction of new knowledge in the field (p. 5).

The authors of this definition highlight the basic difference between the pedagogical content knowledge of a teacher and a scientist. Even though both are content knowledge experts to one degree or another, a teacher can transform that information in a way that is accessible by the students. A scientist would use that knowledge to construct new information in the field.

MODELS OF PEDAGOGICAL CONTENT KNOWLEDGE

There is no global PCK model; researchers have explained it differently in terms of components in the field. [Shulman \(1987\)](#) explained two dimensions of PCK: knowledge of student misconceptions, errors and knowledge of representation of a subject matter. Based on Shulman's two-component

model of PCK, several conceptualizations exist in the literature. For example, Grossman's model of PCK (Grossman, 1990) included knowledge of representations and strategies, student learning and conceptions, curriculum available for teaching, and purposes for teaching a particular subject. Building on Grossman's model, Magnusson et al. (1999) conceptualized PCK for science teaching as consisting of five categories. In this model, components included orientation toward science teaching, knowledge about science curriculum, knowledge about students' understandings of specific science topics, knowledge about assessment in science, and knowledge about instructional strategies for teaching science. Ball and her colleagues (Ball, Thames, & Phelps, 2008) further expanded on Shulman's model of PCK and included knowledge of content and students, knowledge of content and teaching, and knowledge of the curriculum. Most of these models exist in regular education and focus on specific content knowledge in areas such as math, science, or English. The development of them did not necessarily consider either students with disabilities or special education teachers.

SHULMAN'S MODEL

Shulman's model of teachers' knowledge has three categories: (a) subject matter knowledge, which is further divided into syntactic knowledge and substantive knowledge; (b) pedagogical content knowledge, which is further divided into knowledge of comprehensible representation and knowledge of learners' difficulties; and (c) curricular knowledge, which is divided into lateral curriculum knowledge and vertical curriculum knowledge.

Subject Matter Knowledge

Teachers' content knowledge is the knowledge a teacher possesses of the content of a subject. It refers to factual information, organizing principles, and central concepts. Shulman (1986) explains that knowledge of content should not only contain factual information; it must also embody the ground rules and organizing principles of the content. Thus, a teacher must know the 'why' and 'how' of a concept in addition to 'what.' In addition to clearly defining and analysing these concepts, an expert in the content area is able to explain the underlying connections and relationships among these concepts. Shulman divided content knowledge into the following three categories: substantive structures, syntactic structures, and teacher beliefs. Substantive structures are different modes in which the explanation of basic concepts and principles of the discipline are coordinated to incorporate its facts. Mostly, teachers acquire knowledge about the substantive structures of their discipline in undergraduate and graduate course work during which they get acquainted with various

theories and principles related to that specific content area. Syntactic structures provide a means for establishing the reliability and validity of the information in the discipline. Academic subjects do not survive only on concepts and organizing frameworks; new knowledge is brought constantly into the field and members use the means provided by syntactic structures to guide further inquiry. Teacher beliefs are the ways teachers perceive the nature of the subject matter in relation to how they learn and how they will facilitate this information to their students. Teacher beliefs also embrace the experiences teachers have in content and methods courses.

Pedagogical Content Knowledge

Shulman explained pedagogical content knowledge as knowledge of learner's difficulty and knowledge of comprehensive representation. Knowledge of learner's difficulty includes students' understanding, experiences, conceptions, and misconceptions related to a particular topic. In order to develop new schemas or construct new information, teachers must have knowledge of students' comprehension levels as well as their misconceptions about a topic. Teachers could provide meaningful situations in learning to modify and construct new schemas of information. Knowledge of comprehensive representation embodies different ways of presenting a concept to students in order to satisfy their diverse needs. A teacher could use analogies, illustrations, examples, explanations, and demonstrations to project information in such a way that it is easily comprehended. Pedagogical content knowledge is a set of special attributes that help a teacher transfer content knowledge using different teaching modalities to make it comprehensible. Pedagogical content knowledge is a special combination of content and pedagogy that is uniquely constructed by teachers; thus, it is the "special" form of an educator's professional knowing and understanding. Pedagogical content knowledge also is known as craft knowledge (Berry, Loughran, & van Driel, 2008).

Curricular Knowledge

Curricular knowledge includes the full range of program design required to teach a particular subject as well as the instructional material available in those programs in accordance with age and grade levels. This embodies anything from motivational activities to course projects to learning activities of a topic in a specific subject within the broader framework of standards and purpose of teaching that subject. Shulman classifies this into two groups: lateral curriculum knowledge and vertical curriculum knowledge. Lateral curriculum knowledge informs a teacher what students have learned in previous grade levels and in other subjects. This helps a teacher to understand the comprehen-

sion level of students in relation to that specific subject and to decide on strategies for imparting new knowledge. Vertical curriculum knowledge, on the other hand, includes the familiarity of topics and issues that students would be learning in future classes (Ball et al., 2008). They further expanded Sulman's components of teacher knowledge base and created a modified model of PCK.

BALL'S MODEL

Ball et al. (2008) investigated the nature of professional subject matter knowledge by analysing mathematic classroom teaching and the content knowledge needed to teach math. In addition to developing the measures of teacher content knowledge, Ball expanded Shuman's PCK model and added two categories under Shuman's content knowledge category. Ball's PCK model contains three components: knowledge of content and students, knowledge of content and teaching, and knowledge of the curriculum.

Knowledge of Content and Students

Ball defined knowledge of content and students as the knowledge that combines knowing about students and knowing about mathematics (content). Knowledge of content and students includes the needs, struggles, motivation, and interests of diverse groups and specific mathematical understanding that recognizes and identifies topics in any given concept that are either hard to comprehend or confusing. Ball provided the following indicators or components that constitute knowledge of content and students: (a) when choosing an example teachers need to predict that students will find interesting and motivating, (b) when assigning a task, teachers need to anticipate what students will like to do with it and whether they will find it easy or hard, and (c) teachers must also be able to hear and interpret students' emerging and incomplete thinking as expressed in the ways that pupils use language (p. 401). Ball provided examples to explain this component. In one, she talked about a subtraction problem, 307 minus 168, and explained that a teacher who could identify and anticipate the most likely student errors exhibits knowledge of content and students.

Knowledge of Content and Teaching

Ball defined knowledge of content and teaching as knowing about teaching and knowing of mathematics (content). Knowledge of content and teaching embodies understanding student comprehension levels, sequencing a topic accordingly, and identifying and implementing multiple ways to represent the concept (such as providing examples, conducting activities, or narrating

experiences). Ball included the following elements in this category: (a) teacher sequence particular content for instruction, (b) they [teachers] choose examples to start with and which examples to use to take students deeper into the content, and (c) teachers evaluate the instructional advantage and disadvantage of representations used to teach a specific idea and identify what different methods and procedure afford instructionally (p. 401). Explaining this component, Ball emphasizes that teachers must make instructional decisions regarding “when” and “how” to involve students in the lesson, where during the discussion they should pause and check for understanding or ask students probing question to ensure comprehension and engage them in critical thinking about the content. Ball explained a teacher must understand the rationale for implementing different strategies to teach a specific concept and how to effectively use them. The authors emphasized that teachers must understand how one teaching strategy is different from another and cautioned about limiting the conceptual information to procedural aspects in order to make the mathematical issues salient and usable by students (p. 402).

Knowledge of Curriculum

The authors mention that they have provisionally placed Shuman’s third category, curriculum, within the PCK model, but they were not sure whether this may be a part of our category of knowledge of content and teaching or whether it may run across the several categories or be a category in its own right (p. 403). Ball adopted Shulman’s definition and components for knowledge of curriculum in their model. This is Shulman’s definition of curriculum knowledge:

Represented by the full range of programs designed for the teaching of particular subjects and topics at a given level, the variety of instructional materials available in relation to those programs, and the set of characteristics that serve as both the indications and contraindications for the use of a particular curriculum or program materials in particular circumstances (p. 391).

Curriculum knowledge constitutes knowledge of resources, teaching strategies, and instructional materials that a teacher could use while teaching a specific concept within the context of a particular core content area. This knowledge also includes understanding the pros and cons of those instructional materials and teaching pedagogies. As explained earlier, Shulman divided curriculum knowledge into two components: lateral curriculum knowledge and vertical curriculum knowledge. Lateral curriculum knowledge includes information and knowledge that students learn in other classes or core content areas such as science, English, or social studies. Vertical curriculum knowledge includes information or knowledge in same content areas, which student either bring with them from the previous classes or would be learning in future classes.

In inclusive education, for effective instructional partnerships and for special education teachers to take the lead roles in teaching, special education teachers need content knowledge familiarity (Keefe et al., 2004; Morocco & Aguilar, 2002; Scruggs, Mastropieri, & McDuffie, 2007; Zigmond & Matta, 2004). Moreover, missing is research that provides a fine-grained analysis of what special educators' contributions to content teaching look like. The literature does not provide specific descriptions of these contributions in terms of suggesting and implementing a particular teaching strategy or modifying a specific topic in a curriculum within a particular content area such as biology or math which Ball defines as different indicators of KCT.

Familiarity of content would help a special educator to be confident with the content, and this helped him/her select appropriate examples while teaching. These would not only help students comprehend the concept, but also would connect the concept with daily experiences and with other content areas to aid comprehension. Moreover, special educators understanding of their students and familiarity with the content would help them anticipate and identify where in the lesson students would struggle or would get confused and what examples and/or activities' students would find interesting or hard (Tandon, 2013). It would also help them recognize the evolving knowledge of students, which Ball defines as different indicators of KCS.

In nutshell, knowledge of PCK would help both teachers, especially special educators in co-teaching to take the lead teaching role in teaching children with and without disabilities.

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