

Rethinking About the Pedagogy for Pedagogical Content Knowledge in the Context of Mathematics Teaching

Mehmet Fatih Özmantar
Gaziantep Üniversitesi, Gaziantep, TURKIYE

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This study reconsiders the notion of pedagogy for pedagogical content knowledge in the context of teaching mathematics. The perspectives of critical pedagogy are employed for this reconsideration, stressing the operation of historical, social, ideological, political, institutional and cultural forces in the production of pedagogical practices. The effects of those forces on the production of pedagogical practices are exemplified with empirical data obtained from one classroom teachers' instructional practices in the context of mathematics teaching. The paper discusses how these dynamic forces shape the conditions under which pedagogical practices of teaching mathematics come into life.

Keywords: Critical Pedagogy, Mathematics Teaching, Pedagogical Content Knowledge, Teacher Practice

INTRODUCTION

The construct of Pedagogical Content Knowledge (PCK) entered into teacher education discourse some 25 years ago with Lee Shulman (1986, 1987). Basically, PCK refers to a blend of content and pedagogy and involves:

the most useful forms of [content] representation... the most powerful analogies, illustrations, examples, explanations, and demonstrations – in a word, the ways of representing and formulating the subject that makes it comprehensible for others... [PCK] also includes an understanding of what makes the learning of specific concepts easy or difficult (Shulman, 1987, p.9).

Following its introduction, PCK has gained a tremendous popularity in the circles of teacher educators from many different domains (Uşak, 2009; Abd-El-Khalick, 2006) and become subject of numerous research articles, dissertations, and

conference papers in mathematics education (e.g., Ebert, 1993; Stump, 2001; Staley, 2004). The notion is also included in course syllabi as part of both in-service and pre-service mathematics education programs (Özmantar et al., 2010). Despite ever increasing number of studies on PCK, as Kinach (2002) points out, Shulman's characterization of the notion has remained mostly unchanged. This is partly because PCK is treated as if "representing common sense" (Bullough, 2001) and consequently, as Segall stresses (2004), many give in-passing citations to Shulman as the author but do not scrutinize the notion critically.

The core idea of PCK is making the subject at hand such as mathematics comprehensible for learners through the most useful forms of representations and most powerful formulation of the content which depends on the judgments upon what makes learning of specific concepts easy or difficult. Considering that PCK is originally conceptualized as an amalgam of content and pedagogy, it can be inferred that these judgments (and resulting instructional actions) are related to both one's content knowledge and pedagogy¹.

Correspondence to: Mehmet Fatih Özmantar, Ph.D in Mathematics Education, Gaziantep Üniversitesi, Eğitim Fakültesi, İlköğretim Bölümü, Gaziantep, Türkiye
E-mail: ozmantar@gantep.edu.tr

¹ This is not to draw a demarcation line between the content and pedagogy, which is inappropriate and would eventually lead the

State of the literature

- This paper focuses on the notion of Pedagogical Content Knowledge (PCK) which entered into teacher education discourse some 25 years ago.
- Content dimension of PCK in teacher practices was subject of many research attempts. However, pedagogy dimension of PCK did not receive sufficient attention neither from the originator of the idea nor from its subsequent engagements in the relevant literature.
- This study takes a step forward and reconsiders the pedagogy dimension of PCK in the context of teaching mathematics. For this reconsideration, the construct of critical perspectives of pedagogy is employed and the operation of certain forces in the production of pedagogical practices is examined.

Contribution of this paper to the literature

- This study explicates the influence of pedagogy on mathematical knowledge construction, distinguishes various forces shaping the pedagogical perspectives and decisions, and delves into the relationship between pedagogy and ideology.
- The paper draws attention to how pedagogy has the power to be socially and politically transformative even while teaching of a subject such as mathematics that is tended to be seen as apolitical.
- It raises several issues for teacher educators to consider in designing mathematics methods courses with the purpose of developing PCK for both in-service and pre-service teachers.

Content dimension of PCK and its effects on one's actions and decisions in a teaching practice have been subject of many research attempts. These studies provide convincing evidence that depth of content knowledge makes differences in, for example, teachers' questioning techniques, feedback quality, and explanations (see Manouchehri, 1999; Galuzzon et al., 2000; Kinach, 2002).

However what roles do pedagogy play in shaping teachers' instructional practices with regard to PCK? Examination of the PCK literature with this question in mind reveals that the notion of pedagogy has not received sufficient attention it deserved neither from

discussion to go astray. Teachers' pedagogical practices are embedded in a milieu created by the context of teaching a particular topic/content. Hence such a separation is an imaginary one and preferred for report purposes only.

Shulman and his colleagues nor from its subsequent engagements in the research literature. Most past and present examples of the research literature dealing with PCK put a heavy emphasis on how it can (and ought to) be employed for teacher preparation and measurement of the quality of instructional practices (Segall, 2004). Such a heavy emphasis on these aspects seems to create a tendency among the researchers of PCK to treat pedagogy as a 'given', as if it were a self-evident term. This often leads to oversimplified interpretations of pedagogy such as what teachers do in classrooms and their knowledge of teaching (e.g. Cochran et al., 1993). Such oversimplifications disassociate pedagogy "from its implication in knowledge, politics, power, and discourse" and reduce it to "methods of instruction in classrooms" (Segall, 2004, p.491) and to decoding the text (Giroux, 2000). Hence, as Segall (ibid.) points out, the notion of pedagogy remains an under-developed dimension of PCK.

This paper aims to take a step forward and reconsiders pedagogy dimension of PCK with particular reference to teaching mathematics. To this end, I find helpful the construct of critical perspectives of pedagogy. These perspectives direct attention to certain forces intricately operating in the production of teachers' pedagogical practices (PPs) with regard to PCK; that is, the practices performed to make the content comprehensible for the learners. Hence in my reconsideration of pedagogy dimension of PCK, I examine and explore, through empirical data, the forces that shape teachers' PPs. To do so, I first focus my attention on the notion of pedagogy from the critical perspectives in the following section. Then, I briefly detail the background of the study and methodology. I later analyze data to explicate the effect of those forces suggested by critical perspectives on the production of PPs in relation to PCK. The paper ends with a discussion of the issues emerging from the analyses and educational implications of the findings.

PEDAGOGY FROM THE PERSPECTIVES OF CRITICAL STUDIES

Critical pedagogy rooted in Marxist and neo-Marxist critical theory represents efforts of those who question and stress political, ideological, and cultural domination in the course of teaching and learning processes within educational institutions and other media (see Gruenewald, 2003). This area of study does not explicitly engage in PCK; yet the production of knowledge and meaning is also central to the works of critical pedagogy. The notion of pedagogy in critical perspectives concerns the conditions under which knowledge and knowing (or meaning) are produced (Lusted, 1986). Hence pedagogy, Simon (1992) argues, has an intention to regulate and organize the practices

of knowledge production. Simon further argues that it is pedagogy “through which we are encouraged to know, to form a particular way of ordering the world, giving and making sense of it” (1992, p.56). This suggests that PPs, implicitly or explicitly, attempt to influence experience and do this with an intention. Such viewed, any message whether it be in a text, action, or structure is inherently pedagogical (Segall, 2004).

This view echoes in Giroux and Simon’s (1988, p.12) consideration of pedagogy, which:

organize[s] a view of how a teacher’s work within an institutional context specifies a particular version of what knowledge is of most worth, in what direction we should desire, what it means to know something, and how we might construct representations of ourselves, others, and our physical and social environment.

Important in this quotation are two ideas. First, the authors relate pedagogy to the creation of a version of knowledge, specification of the worthiness of knowledge and construction of self-representations – i.e. formation of self “what is to be a person, an individual relating to the others and to the wider society” (Alexander, 2004, p.12). These are all ideological work and indeed Giroux and Simon relate pedagogy to ideology here (for more on ideology, see Althusser, 1970). Second, the authors consider pedagogy as a particular form of institutional practice. They propose an expanded version of pedagogy in different contexts of institutions or “multiple forms of cultural production and not just in those sites which have come to be labeled schools” (ibid., p.21). The kind of sites that the authors have in mind varies; ranging from film-making to theological work, to advertising. These sites, just as schools, involve forms of cultural work. Social relations, experiences and ideologies formed in any site can exercise an influence on teachers’ work in schools. Hence teacher pedagogy is a result of personal histories and of the practices within and among particular sets of social relations, experiences and ideologies of the cultural sites.

Davies (1994) also relates pedagogy to knowledge production but this time with regard to the interpretations of the educational aims and the means to fulfill these:

pedagogy involves a vision (theory, set of beliefs) about society, human nature, knowledge and production, in relation to educational ends, with terms and rules inserted as to the practical and mundane means of their realization (p. 26).

Here Davies nicely articulates the dependence of PPs on one’s beliefs about what characterizes and motivates the learning. Davies also emphasizes the contingency of pedagogy upon the interpretations of how produced knowledge is related to the educational ends which are often determined by policy-makers who prescribe and/or proscribe what is to be taught and how (Alexander, 2004).

This brief consideration suggests that pedagogy is concerned with production of knowledge and the conditions under which such production takes place. Critical perspectives stress that the conditions are historical, social, ideological, political, institutional and cultural; and hence pedagogy cannot be conceived in isolation from the impact of those forces. The insights of critical pedagogy provide a perspective on the forces shaping teacher’s PPs and hence deepen our understanding of pedagogy dimension of PCK. Nevertheless considerations of critical studies often remain at a theoretical level, which is hence abstract and general in nature. They do not provide fine-grained analyses of PPs to show the effect of those forces on the production of teachers’ PPs. This might be because the ways in which these forces influence PPs are not made sufficiently clear to enable a fine-grained analysis of teachers’ classroom practices necessary for gaining insights into teachers’ PCK. In this study, I will make an attempt to clarify the effect of these forces on the conditions under which PPs come into life in the context of teaching mathematics.

BACKGROUND OF THE STUDY AND DATA ANALYSIS PROCEDURE

In this part of the paper, I provide a brief background of the study and data analysis procedure in two sections. The first briefly details the project that led to this paper and the second presents particular data collection tools and data analysis procedure.

Background of the study

This paper stems from an ongoing research project with regard to a curricular reform in 2005 in Turkey. Reform curriculum emphasizes student-centered teaching and privileges conceptual understanding for students. It also aims to develop certain skills for the graduates of primary education (15-year-old) at any subject including mathematics, involving creative and critical thinking, problem-solving, performing research and use of digital technologies (MEB, 2005a). The project aimed to devise and try out a professional development program for elementary teachers in science and mathematics. The purpose of the program was to equip teachers with the necessary skills to implement the reform curriculum as intended.

Some 45 teachers (of whom were 15 science, 15 mathematics and 15 classroom teachers) voluntarily participated in the project during which they were trained through workshops. The teachers also read articles, prepared lesson plans, examined curriculum scripts, analyzed video records of classroom practices, observed and reflected on their own and peers’ teaching

practices². There were several data collection tools employed during the project, including initial surveys, video records of participants' teaching practices, open-ended questionnaires, course/workshop evaluation sheets, self-evaluation forms, semi-structured interviews on their preparation, on their teaching practices, on workshops' benefits. In this paper, video-records of teaching practices and interviews are employed as sources of data, which will be described next.

Data collection and analysis procedures

This paper focuses on one male primary classroom teacher, Suat, who has been teaching for 9 years. In Turkish primary education system, classroom teachers typically teach Grades 1-5 and their teaching responsibilities include Reading and Writing, Turkish Grammar, Mathematics, Science and Technology, and Social Sciences. Suat was selected for this study as he was self-reflective and open to collaboration. He joined the research project and was followed in 2009-2010 academic year. During this period, 2-3 hours of his teaching mathematics were video-recorded each month; this amounted to a record of 20 hours of teaching. Video-records of Suat's teaching practices were initially examined. This examination focused primarily on his PPs. Following Giroux and Simon (1988), PPs are defined as actions and decisions which intentionally try to influence the production of meaning. Hence during the examination of teaching videos, particular attention was paid to Suat's actions and decisions on the conduct of his mathematics teaching, on the partitioning and the structure of his lessons. Also his approach to the delivery of the mathematics content was critically evaluated. Consequently, certain characteristics of Suat's PPs were determined. In order to understand how Suat decided what approach was the best in making the mathematics content comprehensible, retrospective interviews were conducted. While interviewing, one of his teaching videos was examined together with Suat in one-to-one situation. During this process, the video was stopped at those moments which were determined beforehand. Questions were directed to Suat about the issues commonly observed in all his recorded lessons (see below) to uncover the reasons for and rationales behind his PPs. Hence the data for this paper are composed of video-records of Suat's teaching practices and retrospective interviews on his practices.

THE DATA

This section focuses on the analysis of Suat's retrospective interview (lasted about 3.5 hours) The

² For more information on the Project, see www.ogretmenegitimi.org

interview performed in Turkish was later translated into English. Two main principles for translation were the lucidity of the content and the reflection of the original intent. The interview was carried out on the basis of a lesson where Suat was teaching commutativity of multiplication to a class of 40 Grade-2 (aged 8) students. This particular lesson (lasted about 40 minutes) was used for Suat to see examples of his common practices while teaching mathematics and created the context for the retrospective interview. Before providing the interview excerpts, I briefly present Suat's lesson employed during the retrospective interview and explain the preparation process for the retrospective interviews.

An overview of Suat's multiplicative commutativity lesson

Suat has already taught the multiplication and the meaning of multiplication in his previous lessons. In this particular lesson, he aimed to teach the multiplicative commutativity through grouping; that is, adding the number of elements in the groups which have the same number of elements (i.e. a form of repeated addition). He called 8 students on the board and composed two groups of 4 students. He later invited students to find the number of students on the board by using the group number and the number of students in each group. With the whole class discussion and carefully examining all the answers produced by the students, the class came to conclusion that the total number of students in the groups could be calculated as "2 times 4" (2 groups with 4 members in each). Suat later invited the class to discuss other possibilities of group formation with equal number of members. Following student answers, Suat re-arranged 8 students, this time into 4 groups with two members in each. He once again asked students to find the number of students without counting individually. The class came to conclusion that the number of students in groups could be calculated as "4 times 2" (4 groups with 2 members in each). Suat invited the whole class to discuss the results and the arrangements of the numbers in each of these multiplications. Through discussion, students realized the multiplicative commutativity and lesson ended with Suat's explanation of what they had done and why changing number place in multiplication made no difference.

Preparation of Retrospective interviews

Before performing the retrospective interviews, all 20 hours of Suat's videos of mathematics teaching were examined. This examination led to determination of certain characteristics of his PPs. Among these characteristics, Suat:

- ✓ asks questions but does not label student answers right or wrong.

- ✓ *pays attention to get less-able students actively involved in his teaching.*
- ✓ *allocates long waiting-time for his questions (sometimes extending beyond 30 seconds).*
- ✓ *is concerned with providing justifications.*
- ✓ *encourages students to share disagreements and to reach at resolutions.*
- ✓ *ends discussions with his “version” of explanations.*
- ✓ *solves, while introducing a new topic, limited number of mathematical examples (one or two).*
- ✓ *has a slogan to express the core idea of a new mathematical topic.*

The above list represents a characterization of Suat’s PP which embodies attempts to make mathematical content comprehensible to learners, and hence his PCK. To gain insights into each of these characteristics, Suat was interviewed retrospectively. During the interview, Suat watched video-record of multiplicative commutativity lesson; he was asked questions about each of the characteristics of his practice (listed above), all of which were also observable in the particular lesson shown to him.

Retrospective interview excerpts

This section presents excerpts from retrospective interview with Suat on each characteristic of his PP. Note that while presenting the excerpts, I provide my interpretations which might not be necessarily comprehensive or definitive in nature.

The first issue of the interview was about his avoidance to label student answers right or wrong. Asked about the reason for doing so, he responded:

Classroom environment at this level can be very cruel. Everything with which teacher isn’t happy is doomed to be excluded by students... If a child talks and is said to be wrong, others don’t listen to him/her anymore...but we want everybody in class listen to one another, care what others say.

Apparent in Suat’s response was an awareness that he represented a power figure and the effect of his power might lead to exclusion of some. Yet in his view, classrooms should be forums where everybody cares about the others. He was much concerned with the ones considered by their peers, as “the others” who were less-able and silent. Suat encouraged these students to actively join his lessons. Suat explained the reason as follows:

I try hard to get those less-able ones in mathematics involved in the lesson; who are regarded as “the other” by their friends. I ask them something they can answer easily. I fear the most that students feel they won’t never understand. If you’re convinced that you’re useless then it’s the end. You learn helplessness.

Suat was aware that some less-able students were regarded as “the others” by the members of his class and he struggled to overcome this perception by asking

“easy” mathematics questions that “the others” could answer. But what benefit did he expect from the involvement of “the others” into his classroom activities? His answer suggests that this practice was partly related to his vision of society and individuals’ places in the society:

It’s a matter of diversity and equity. Everybody can learn maths and science...you need to give them a chance...encouragement...That’s equity and giving one an opportunity; a usually ignored and silenced one... Maybe it’s cliché but we want a society where everyone is happy, live as they wish, tolerant to one another, and no such thing as “the other”.

A common practice of Suat’s instruction was his allowance of long waiting-times for students to answer his questions. With this practice, he aimed to help students think about and answer his questions:

When I feel that the child is thinking, making an effort, then I wait for a response. Usually they give me an answer which is likely to be right. If not, I help or ask something easier that he/she can answer. The class develops a perception that everyone deserves the right for thinking even if it takes time. The class really learned to wait for the slow and less-able ones.

Another important aspect of Suat’s mathematics teaching was his insistence on justifications and/or explanations for the answers elicited from the students. His rationale behind the practice was as follows.

Without justification, the answer remains short and weak, which might be found by chance. Also the new curriculum expects us to teach critical and creative thinking skills in mathematics. Justification is key to develop those skills. But more than this, I want my children to be listened to by their parents, valued by their peers. People often oppose many things but don’t give reasons or justifications. But if you give your reason, you can convince and are taken seriously in today’s society. This is the case whether you take a job interview or get accepted in a social group...

This excerpt reflects Suat’s vision of a society where justification plays an important role not only to learn mathematics but also to be a successful member of the society and taken seriously. He was in a sense specifying a particular version of what knowledge was most worth (Giroux & Simon, 1988) for his students. In his efforts, he seemed to be aligned with the perspectives of curriculum reformers regarding the importance of critical and creative thinking skills, development of which, to Suat, were dependent upon the ability of providing justifications.

While teaching mathematics, Suat consistently encouraged students to express their disagreements, defend their ideas and find resolutions without his involvement. When asked why he insisted on this, Suat replied:

They have to learn to communicate and resolve their problems among themselves without a figure of authority so that they

can walk with more sure steps in the life. Beyond this, knowledge is reached through your own efforts and struggles. I try to give my kids that opportunity. They make comments, think and talk; construct the knowledge by themselves.

Suat was considerate to give students a chance for content-related class discussions. However, he was also concerned with the issue of how to end the class discussion. This is because class discussions could result in the production of diverse and sometimes inaccurate mathematical explanations. Suat was aware of this and he ended class discussions by providing mathematical explanations of what was to be learned.

The thing that reside in child's mind is the last thing told in the class. They remember the last thing they hear. So after the class discussion I always tell the students what the correct answer/explanation is.

This and previous excerpts reflect Suat's vision on human nature and knowledge production (Davies, 1994); for example, to him, knowledge could be produced through one's own efforts and struggles and children remember the last thing told in the class. He also had his own terms and rules inserted into his practical means of realizing knowledge production: getting students to comment, think, and talk among themselves and then present the correct answers/explanations. This practice was intended for a successful teaching of mathematics and was part of Suat's PCK. However, Suat's practice had an intention which went well beyond teaching mathematics: he attempted to organize his students' experiences as well as organized his students to experience the world in particular ways (Segall, 2004).

One of Suat's common practices was that when introducing a new mathematics topic, he focused on a limited number of examples (e.g. two examples on multiplicative commutativity). He explained the reason for his practice as follows:

When I focus on a couple of examples, many students join the lessons, share their views, generate many mathematical explanations. That is what I desire with limiting the number of examples: active participation and sharing, hearing, defending views by students. When we have in-depth conversation with the class on the topic, my students start to realize things that they never did before.

This quotation reflects an important pedagogic decision on the part of Suat who chose to focus on two examples to get "in-depth" conversation with the students whose views mattered in his class. However, with this decision Suat breached his compliance with mathematics textbooks and he was aware of this:

The textbook suggests for one lesson 5-10 examples and expects the teacher to cover them all. But new curriculum aims to get students expressing themselves; couldn't they foresee that too many questions inhibit us from doing so? This is impossible especially if you introduce a new maths topic. If you

want to achieve conceptual understanding and use examples for this purpose, then you may answer only one or two.

In the last two excerpts, one can see Suat challenging the textbooks prepared in accordance with the mathematics curriculum scripts. Suat recognized and understood but was critical of and hence dismissed the prescribed practices of mathematics textbooks (of solving 5-10 examples one after the other without in-depth conversation with students). To justify the appropriateness of his practice he noted:

We're gotten to memorize the multiplication table and asked tens of multiplications from the table and had to answer quickly. When failed, our maths teachers got angry, scolded us. Our teacher didn't bother to explain the logic behind it. We learnt in this way...but learning mathematics was a total torture and painful experience. We were taught in this way and I taught it in this way in the past. But now I emphasize the logic and the connections very much and children discover it. Multiplication is understood in my class very easily.

To Suat, establishing connections and explanations of "logic" were indispensable elements for making the mathematical content comprehensible for his students. His recognition of the importance of these elements was rooted in his past experience both as a student and teacher.

During our interview, Suat repeatedly mentioned his aim to make students happy; when asked about the source of his insistence on happiness for his students; he responded:

I'm influenced by movie called Good Morning Vietnam. The soldier in that movie took happiness wherever he went. He was facing resistance but he was able to make people happy. When I first started teaching in a small village, this character was my source of inspiration...Among the first books I read was "Child Heart" where a new teacher came and changed everything in the school. The way of communication, original practices, value given to students...I always wanted to have such a teacher while I was student...life gave me a chance to become a teacher that I always imagined to have as a student.

It is interesting to see that the books Suat read and the movies he watched played important roles in forming and transforming him as a teacher. Yet movies and the books were not the only sources of inspiration; he accepted the influence of certain professions such as advertising. In this respect, he stated:

I'm the most influenced by advertisers. They use slogans, not found randomly but carefully thought out. But these couple of words make you a brand, trademark. Emphasizing the right parts. You found the right words at the right time and don't need to tell much. Likewise I also have slogans in my lessons. Use them very often. It could be either a funny expression, proverb, idiom that I bend...to make the lesson or my emphasis unforgettable. To support and ease student learning process.

The last two excerpts suggest that Suat's PP was not solely developed in schools; to the contrary his

instructional actions were shaped by the practices and social relations within and among different cultural sites including books, film-making and advertising (Giroux & Simon, 1988). For instance, in his attempts to make the mathematical content comprehensible and unforgettable for his students and to ease and support their learning process, Suat employed slogans, which to him, made the content last longer in the mind of his students. This practice, designated for making the teaching of mathematics a success, was an important aspect of Suat's PCK.

FINDINGS AND DISCUSSION

Video-record and retrospective interview data make two things particularly clear. First Suat explicitly engaged to make the content (i.e. multiplicative commutativity) comprehensible to the students with different backgrounds and with different learning abilities. Second he had a deep subject matter knowledge sufficient at the level that he was teaching. I take these two as evident and do not discuss them further. Instead I discuss historical, social, ideological, political, institutional and cultural forces in shaping Suat's PPs. The general point is that in the course of any PP, all these forces are often co-existent at varying degrees and with relative importance. Hence PPs cannot be best understood in terms of any one of these forces in isolation but rather through a consideration of all these forces. Thus the challenge is to recognize how these integrated and dynamic forces fit into a single picture in determining the conditions under which (mathematical) knowledge is produced. The discussion below aims to take this challenge and to clarify the effect of these forces on the production of PPs. The discussion however focuses on each of the forces separately as if they were isolated. This artificial separation is designated to aid clarity and should not be construed as a theoretical division of the PP.

Pedagogical practices are historically situated

PBs are historically situated in small-time and wider-time scales. Regarding small-time scales, PPs do not take place in isolation from what has already happened in a particular instructional setting. That is, any pedagogical action can be considered as a link in a very complexly organized system of both preceding and succeeding actions. For example, Suat's pedagogic decision upon employing two examples during his instruction determined his practices afterwards. Focusing on two examples during the whole lesson gave Suat sufficient time to hear students' responses to his questions, to allocate longer waiting-times, to allow students to share and defend their ideas and generate explanations. Hence PP is shaped by earlier actions.

Furthermore, PPs are also situated within wider-time scales regarding teachers' personal histories; that is, pedagogical actions and decisions are linked to some previous occasions in teachers' personal experiences. We can see this in Suat's practice of teaching multiplication table through memorization at the initial stages of his career. However, he later recognized the insufficiency of this approach and hence made amendments. He started to teach with "explaining the logic and making the connections" among mathematical structures. Hence, historical aspect of PP does not mean that teachers directly copy and carry their experiences into their classrooms. But rather they challenge and dismiss some meanings encountered in the past; accept, confirm and take further some others as well as modify and distort still the others (Simon, 1992).

Pedagogical practices are shaped by the social forces

There are different ways to see the notion of "social". While some interpret the social in relation to the cultural (psychological) tools employed to undertake actions (see Wertsch, 1998), others consider the interactions of the immediate participants of a discursive activity – usually face-to-face interactions (e.g., Rogoff, 1990; Mercer, 1995). Still others interpret the social broader than face-to-face interactions, transcending beyond the borders of the immediate context of a setting and does not require the physical presence of the all participants, some of whom might be distant in space and time; e.g. reading and hence interacting with the author of a book (Ozmantar, 2005). This last kind of interpretation of the social might be considered to involve a 'virtual interaction'.

Social interaction with the immediate participants of the instructional setting forms and transforms teachers' momentary interventions which are also dependent on the demands and contingencies of the particular instructional setting. To exemplify, consider Suat's allocation of long-waiting times for his questions. If the student is not able to answer the question, he asks an easier one that the student can answer correctly. This particular action on the part of Suat comes about as a result of interaction with the immediate participants of the instructional setting. So the effect of the immediate participants in his class is too obvious on his PPs.

However, a more salient influence (and even perhaps a long-lasting and more profound one) of the social forces on Suat's practices concerns virtual interactions. We can see Suat making his pedagogical decisions on the basis of his virtual interactions with, for example, his past mathematics teachers and students, the authors of the mathematics textbooks, hero of the movies and books and creators of the mathematics curriculum scripts. Suat states to have learned the importance of

making students happy from the hero of the books (e.g. Child Heart) and movies (e.g. Good Morning Vietnam) hence avoids labeling student answers right or wrong; his insistence on providing justifications has partly rooted in virtual interaction with the creators of curriculum scripts, which themselves are cultural tools (Wertsch, 1998). His emphasis on “logic and connections” while teaching mathematics has come about through his interaction with his past teachers of whom Suat was critical as they “didn’t bother to explain the logic” and hence “learning mathematics was a total torture and painful experience”. As these examples clarify, Suat’s momentary interventions in teaching mathematics and hence PPs are shaped and developed through the virtual interaction with certain agents who are distant in space and time.

Pedagogical practices are ideological works

One broadly perceived usage of the term ideology concerns some kind of consistent and rigidly held system of political ideas (Kavanagh, 1990). Employed in this sense, ideology implies a derogatory meaning and is used to describe those who aim to impose a political obsession, usually extremist one, on a moderate political system (ibid.). However this dominant understanding of the term does not reflect its conceptualization in critical theory and cultural studies. In this tradition, ideology is, broadly speaking, considered as a rich system of representations cultivated through particular material experiences of individuals (Althusser, 1970). It is through these experiences that individuals become social subjects who freely internalize a “picture of their social world” and assign a position for themselves in this world (Kavanagh, 1990, p.310). Such viewed, ideology veers away from being a set of rigid political ideas and constitutes a framework of thought to shape certain assumptions as to the self and rationalizes its relation to (both social and material) world (Bartolome, 2004). This position regards ideology as a necessary component of the sociality, “a structure essential to the historical life of societies ... indispensable in any society if men [*sic*] are to be formed, transformed and equipped to respond to the demands of their conditions of existence” (Althusser, 1970, p.234-35).

Based on this brief consideration, I argue that PP is in essence an ideological work in that it constitutes a framework of thought for individuals to appropriate the social order and social world; assigns a position in and rationalizes their relation with the world around them. Further to this, PP provides individuals as social beings with material experiences through which their selves or subjectivities are formed, transformed and equipped to act in accordance with the demands of particular settings. Formation of selves through PP depends on teachers’ visions of “what is to be a person and an

individual relating to others and to the wider society” (Alexander, 2004, p.12).

This argument can be corroborated by virtue of Suat’s PP, through which he engaged in the creation of framework of thoughts and hence attempted to form the subjectivity of his students in complex and delicate ways. Take for example Suat’s allocation of longer waiting-times for his students when necessary. He was doing so to ensure that students were given opportunities to produce answers to his questions. This characteristic of his PP involves ideological overtones. Engaging in this practice, Suat aimed to form a framework of thought for his students: “everyone deserves the right for thinking even if takes time”. In doing so, he created a base on which social order of his class (which certainly transcends beyond the boundaries of his classroom) was appropriated by the members and enacted accordingly. That is, with Suat’s words, “the class really learned to wait for the slow and less-able ones.” In fact this enactment comes about through material experience provided by Suat’s practice and is an indication of the rationalization of students’ relation with the social world around them.

Inherent in Suat’s PPs was a sense that assigned certain qualities to the individual, defined a place in the social world; that is, an envisaged selfhood for his students both in relating to one another and to the wider society. We can see Suat attempting to form those images of the selves (at times idealized perhaps) through his PPs. Consider, for example, his avoidance in making explicit judgments upon the accuracy of student statements. The reason he cited for this practice was that the class “can be very cruel. Everything with which teacher isn’t happy doomed to be excluded by students”. So his pedagogical actions and decisions are shaped with a concern of specific relations of power and a desire to achieve an inclusive instruction. This is an important pedagogical decision in and of itself since such a decision can have profound impacts on the conduct and structure of one’s (mathematics) teaching (which might have diverse effects on the motivation of able-ones, require teacher to vary instruction accordingly and so on). Yet he insisted on taking those on board regarded by the class as “the others...usually ignored and silenced ones.” This is because Suat has a picture of a society where people are “happy, live as they wish, tolerant to one another and no such thing as the other”. All these remarks point out that his PPs aim to instill students with certain assumptions, views and values, all of which somehow define what is to be a person (self) and individuals’ relationships with and within the society. On the basis of these considerations, it could be safely concluded that Suat’s PPs were saturated with ideological overtones.

My consideration of PPs as ideological works should not be taken to mean that primary function of

ideological discourses is to “convey knowledge”. To the contrary, ideology is primarily concerned with adjustment, formation and transformation of social beings. Of course, ideologies could contain and convey some knowledge but, I agree with Kavanagh (1990, p.314), they “are not vehicles for producing knowledge” and should not be judged to be so. However PPs with regard to PCK is always concerned with the production of knowledge and designates vehicles for that purpose. Hence ideological effects are not a duplicate of pedagogical ones; yet they are connected in specific, delicate and complex ways.

Influence of political apparatuses on the production of pedagogical practices

There is a sense in which the politics is regarded as state policies and party activities (Carspecken, 1991). This sense of politics appears to have received much research attention. The studies conclude that schools provide a forum for students’ political socialization through three channels: textbooks (which directly touch on political themes), school climate (schools’ educational and social practices) and teacher (serving as agents of political socialization by referring to current political events) (see Bar-Tal & Harel, 2002). These surely constitute means for political socialization of students. However the notion of politics I have in mind, though include these channels, is not limited to the effect of them. The politics works in some surreptitious and intricate ways in shaping teachers’ PPs in virtue of national or local policies which prescribe or proscribe, enable or inhibit what is to be taught and how (Alexander, 2004). To exemplify this argument with Suat’s practice, a brief background of the curriculum reform in Turkey is necessary.

Curriculum reforms are political in nature and Turkish experience is no different. In the information handbook of the new curriculum (MEB, 2005a), one motivation for the curricular reform is stated as the changes in the world economy as a result of globalization: the world economies have become more competitive and the individual qualities to respond to those demands have changed. Policy-makers’ vision of an individual to cope with the newly emergent demands of globalized world leads to the determination of certain qualities for Turkish students, who are, upon their graduation of primary schools, expected to have such skills as critical and creative thinking, questioning, communication and initiation, and problem-solving. To make the reform a success, all the textbooks have been re-written and freely distributed to students; teacher handbooks were prepared and also distributed freely; teachers were trained as to the aims and spirit of the new curriculum (which is more of a “constructivist” one); national and local high-stake exams were re-

designated to ensure the production of endorsed content; and many research undertakings all around the country were funded. The curriculum reform can be considered as an attempt to re-define and “construct the state’s version of citizenship and national identity” (Giroux, 2000, p.350) with a renewed understanding of social, cultural, economical terms in globalized world.

Curriculum scripts with the aim of development of target skills, textbooks, training conducted by the officials from the Ministry, local and national exams, and sparing funds for relevant research are among the political apparatuses that aim to ensure the production of certain classroom practices. Curriculum scripts prescribe certain approaches to teaching as embodiments of desired practices with its expected outcomes; textbooks prepared in accordance with the scripts aim to ensure the occurrence of those practices and involve sanctioned knowledge to be produced and reproduced through such practices.

Suat’s practices were not immune from the influences of those political apparatuses as has become evident in our interview. Certain characteristics of Suat’s PP emanated directly from these apparatuses. For example, he was continually asking for justifications (so that he can develop “students’ questioning, creative and critical thinking skills that the new curriculum expects”); he attempted to get the less-able ones involved into his teaching (because, Suat states, “everybody can learn maths” which is the ‘motto’ of the new mathematics curriculum—MEB, 2005b, p.7); he taught multiplicative commutativity through grouping (which is the prescription of mathematics textbooks that he followed). All these suggest that Suat’s PPs were deeply influenced by the political apparatuses. The point here is that the politics through several apparatuses, including instructional ones, impose an authority on the production of certain PPs to produce sanctioned knowledge.

Effects of institutions on pedagogical practices

The term institution is an oft-cited by the students of cultural critics yet it is perhaps the least explored one; this is probably because the theory of institutions can be described as “work in progress” (Searle, 2005, p.22). Yet, the studies have made it sufficiently clear that institutions are cultural sites concerned with the occurrence of certain collectively accepted (or shared) actions. It is through institutionalization that these actions (rules, activities, relationships, norms and rituals) become prescribed and hence “routinized” (Crossan et al., 1999). To achieve this, institutions establish systems, structures and procedures; and also identify categories for social actors by assigning them statuses and powers to ensure the production of prescribed actions (Searle, 2005). My argument is that teachers’ PPs are shaped by

the organizational structures of institutions, by the institutional rules and rituals, and by the status-power relations.

Teachers' PPs do not take place in a void but rather always in the context of a school which has its own organizational structure. A common school structure including the one where Suat works is what Cuban (1995) call "age-graded". In this structure, as Cuban explains, school has multiple isolated classrooms each of which is assigned to a teacher who teaches a group of students (often 25 or more) who are at about the same age with different backgrounds and motivational levels. Such a structure surely affects teachers' instructional practices in different ways. Teachers at least need to maintain control, motivate students, to cover curriculum partitioned into grade-level chunks for each subject matter during a multi-period (45-50 minutes) school day (Cuban, *ibid.*). We can see the effect of such organizational structures on Suat's practices. He, for example, had to vary levels of his instruction due to differences in abilities and motivation level of his students and preferred not giving feedback on the accuracy of student responses to prevent potential exclusion. Furthermore, he was making his own adjustment to the delivery of the mathematical content (focusing on two examples rather than 5-10 as prescribed in textbooks) as he was a self-reliant practitioner in his classroom isolated from the inspection of any authority.

The organizational structure with all the social actors also leads to the creation of institutions' own peculiar rules and rituals, which certainly influence the occurrence of PPs. For instance, students sit on desks arranged into rows, allowing teachers an easy surveillance to maintain control (Cuban, *ibid.*). During instruction, students ask permission to talk by raising their hands and are allowed to speak only if allowed by the teacher. Such rules and rituals create a base for PPs to come into existence. Suat's PPs of, for example, asking students to discuss, find resolutions for the disagreements, sharing and defending ideas, waiting for the slow-ones would be rather difficult without such rules and rituals.

Rules and rituals are, however, cannot be fully meaningful without consideration of status-power relationships. An important aspect of institutions is that they assign individuals certain statuses as well as powers. Searle (2005) argues that status is a special kind of assignment that enables individuals to serve certain functions. This applies to all agents of schools including teachers and students. Statuses inherently involve assignment of powers which make individuals eligible to perform certain actions. However this power does not necessarily stem from individual's physical structure, capacity or knowledge differences. The power that institutions assign is marked with such terms as rights,

duties, obligations, authorizations, permissions and requirements (Searle, 2005). To clarify, being a teacher is a status assigned to individuals. This status enables individuals, including Suat, to serve particular functions (such as conducting teaching activities) and gives them power to perform certain actions such as having a right to call students on the board, having an authority to decide on whom to direct questions and seek answers. Studentship is also a status that makes individuals eligible or not for membership of a class. This status gives power to individuals to attend the class of a specified teacher, to join classroom activities and to have right to defend his/her ideas. Status-power relationships enable the occurrence of PPs in that such relationship specifies certain roles, duties, responsibilities for the parties involved in teaching/learning process. If Suat was not assigned the status of teacher, he would not have a right to perform his practice within the particular instructional setting, in the given time-span and for these particular students.

Pedagogical practices are cultural products

The literature on culture is rather diverse and relates the notion to a wide range of issues including the social, historical, ideological, political and institutional; all of which are subject of previous discussions. However, there are particular themes and recurred understandings that seem to be shared by many. Among them, one aspect of culture is particularly important and immediately relevant to my discussion of PPs as cultural products. That is, culture is concerned with common practices of certain communities (Rogof, 1990) and considered as a particular network of negotiations for the exchange of symbolic and material resources (e.g., history, language, material goods, ideas, values, and people) (Greenblatt, 1990; Giroux, 2000). The exchanges take place within and among different cultural sites (e.g. advertising, and film-making) through conducts, social actions and practices (Giroux, 2000). Practices of one cultural site could exercise an influence by virtue of, for example, values, ideas, mode of social relations and experiences, on the practices of the same or other cultural sites. Viewed from this perspective, PPs can be considered as the cultural products formed and informed by social relations, experiences and institutional practices elsewhere in the culture.

Returning back to Suat's mathematics teaching, his PPs can be viewed as an amalgam of the practices among different cultural sites. In his attempts to make the mathematical content comprehensible and unforgettable for his students and "to ease and support their learning process", Suat said to employ slogans. In his view, slogans as in the case of successful advertisements, make the content attractive and last longer in the mind of his students. This is a practice

which is designated to make the teaching of mathematics a success (whether it achieves this or not is not my concern in this paper) and is part of Suat's PP. This practice, however, is adopted from the advertising industry and described as an amalgam of the social relations and practices of different cultural sites. However the effect of other cultural sites on Suat's practices were not limited to advertising; he acknowledges the influence of the books he read (e.g. *Child Heart*) and the movies he watched (*Good Morning Vietnam*).

Surely the cultural sites that formed or at least informed Suat's PPs are not limited to those sites that he cited during the interview. There are many others, influence of which may or may not be apparent at a given moment of PP. We may be aware of the effect of certain sites while not of the others. It is important to note that the influences of different cultural sites through conducts, social actions and practices do not necessarily consciously enter into one's own world.

This argument however should not be construed as a dismissal of individual agencies. To the contrary, I agree with Giroux (2000) that agency, the linking of capacities to the ability of people to intervene in and change social forms, is neither prefigured nor always in place but it is subject to negotiations. That is, it is not just compliance, conformation or admiration of the practices of certain sites that shape one's PPs; it is also one's distance, rejection and/or dismissal of the practices of other sites which also affect one's PPs. For instance, while Suat was adopting the practice of advertisement, he was distancing himself from the practice of his past mathematics teachers who got them to memorize multiplication table.

CONCLUSIONS AND EDUCATIONAL IMPLICATIONS

This paper stemmed from a recognition that pedagogy has remained an under-developed dimension of PCK and many treated this term as if it were self-evident, or reduced it to what teachers do in the classroom. Teachers' PPs in making the subject at hand comprehensible to the learners remain at the heart of PCK. In my discussion I attempted to establish that PPs are shaped by historical, social, ideological, political, institutional and cultural forces. I exemplified how those forces operate in the production of pedagogical actions and decisions on the basis of one teacher's classroom practices.

An important implication of the findings is that development of PCK is a multi-faceted one and involves a complex set of dynamics. However, there appear many studies which aim to develop (pre-service) teachers' PCK by supplementing them with the knowledge of students' conceptual difficulties and

representations (e.g. Stump, 2001; Staley, 2004). These two are part of Shulman's initial conceptualization of PCK and adopted by many as indispensable part of PCK. In fact, after Shulman, several elements of PCK were distinguished with the research purposes, including knowledge of curriculum, instructional strategies and assessment (see Park & Oliver, 2008). Quite often teachers' development of PCK is related to the teachers' knowledge growth in those areas. Surely such attempts are valuable and contribute to the development of teachers for the better; and hence, in my view, efforts in this direction should continue.

However, as the considerations in this paper suggest, development of PCK is quite complex and involves intricately operating forces which form the base on which PPs in actual classrooms come into life. So ignorance of those forces in the design and conduct of PCK programs might be costly, which even could inhibit endeavors to develop teacher PCK from nearing their ultimate goals. The forces considered in this paper point out areas that require research attention in designing and conducting PCK programs. Our knowledge of these forces enable us to pinpoint the dynamics of change in teachers' PPs and hence equip us to handle the complexities involved in development of PCK. Hence I believe that PCK studies need to also consider and devise ways for teachers to critically reflect on these forces.

At this point an important question arises: why is the ability to critically reflect on the forces that influence the development of PCK of tangible use? Recent literature on effective teachers of culturally diverse students describes teachers as caring, knowledgeable and skilled practitioners who hold an awareness of their own political and ideological positions and effect of these forces on their students' academic performance (Bartolome, 2004). Many research studies from the critical perspectives provide compelling evidence that such an awareness lead to the transformation of teachers' PP from the selection of the mathematical tasks to the way in which they approach to their students. For instance, in their research, Leonard et al. (2010) present several case studies where culturally sensitive tasks were chosen for students to engage in rigorous mathematics. They argue that culturally relevant instruction for students of color coupled with teaching for social justice can motivate underrepresented and marginalized students to learn mathematics.

In a similar vein, Bartolome (2004) points out the ideological and political dispositions often held among White lower-middle and middle-class teachers in the U.S. that view low-income and non-White students through "a deficit lens that position them as less intelligent, talented, qualified, and deserving" (p.99). The author relates low academic performance of such

students to these ideological and political dispositions and to the way in which the content is delivered to the students. In this study, Bartolome shows remarkable increase in the academic performance of such disadvantaged students when they are taught by the teachers who “figure out teaching is not an apolitical undertaking, develop a critical understanding of how asymmetrical power relations play out in schools, and devise strategies on their students’ behalf for short-circuiting potential inequalities they may experience” (p.101).

Although these studies are not immediately concerned with the notion of PCK, their findings underline the importance of forces attended to in this paper while considering teachers’ instructional practices with regard to PCK. In this regard, two critical questions need addressing: (1) to what extent do we, teacher educators, need to work with or against the effect of those forces? And (2) What kind of opportunities do we need to create for teachers to become aware of (and hence face and question) the effects (and/or usefulness) of these forces on their own practices? The present state of research in the area of PCK is not able to answer these questions yet. Hence further research efforts and undertakings are necessary to address the questions posed above so that we can be better prepared to achieve real changes in teacher practices for the better.

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