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INVESTIGATING THE CHALLENGES OF PEDAGOGICAL CONTENT KNOWLEDGE THROUGH THINK ALOUD PROTOCOLS & FINDING SOLUTIONS THROUGH FEEDBACK PRACTICES

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A B S T R A C T

Pedagogical content knowledge (PCK) has received considerable attention among teacher training researchers; however, only a limited number of established empirical frameworks to date have focused on the attempts for ascertaining how PCK is gained and how additional opportunities can be provided for expanding PCK. The premise of this research paper is to contribute to an understanding the challenges that prospective teachers encounter in PCK and to suggest new and alternative practice to help prospective teachers internalize PCK and discuss the gaps through educator and peer feedback. The participants of the study were 81 prospective teachers of English enrolled in the third year of an English Language Teaching—ELT—program at a Turkish university. The introspective methods—think aloud protocols and prognostic exams—and retrospective methods—questionnaires and achievement exams—were used to collect and scrutinize the data. The results suggest that peer feedback for PCK provided through collaborative discussion was more comprehensible and helpful than educator feedback for the prospective teachers, though educator feedback was considered to be more professional.

Keywords: pedagogical content knowledge, peer feedback, teacher training, think aloud protocols.

INTRODUCTION

In teacher training, the attempt for establishing the trainee's professional identity equipped with PCK is among the chief concerns. Although teacher training can be identified as a global notion, teacher training for different subject matters such as language, mathematics, history, science, computer science, etc. needs to be distinguished from each other regarding their focal points on PCK. Among these, language teacher training typically incorporates courses into programs for developing teachers' professional competence in terms of both linguistic competence and pedagogic competence (Cots & Arno, 2005). The demand for competent language teachers may require supplementary approaches for their education and professional development. Borg (2006) emphasizes that language teachers are found to be distinctive in terms of the nature of the subject, the content of teaching methodology, and teacher-learner relationships. The main aspiration of this distinctiveness is that during the training process, prospective teachers are exposed to a bulk of knowledge for developing their linguistic knowledge, subject matter knowledge, and PCK into which teacher knowledge and personal attitudes are penetrated.

How can language teachers be provided with PCK during teacher training process? The chief support is given for integrating linguistic knowledge, content knowledge, and PCK into teacher training curriculum to access ideal teaching criteria as stated by Shulman (1987). In linguistic knowledge, they become skilled at using linguistic features; in content knowledge, prospective teachers are taught theoretical field notes; and in pedagogical knowledge, they learn how to teach. In the field courses, they experience microteaching practice and pedagogical practice in school-based contexts that are expected to be contributing to teaching activities before they graduate from the faculty of education (YÖK

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-Yüksek Öğretim Kurulu: Higher Education Council of Turkey, 2013). Borg (2003) cogently argues that embedded values and attitudes in the classroom in teacher education programs impose the theoretical knowledge on prospective teachers for a professional diploma, and this imposed knowledge is negotiated and conceptualized in school-based contexts where they work as teachers. In this perspective, thinking about the topic, understanding, learning and internalizing it may be consolidated by means of participating in the teaching practice in social contexts. The purpose is to help prospective teachers practice instructional strategies and develop professional consciousness. Thus, they may develop suitable activities while practicing teaching. Academic language and PCK terms may be more comprehensible for them as long as they get the opportunity to practice, and then subsequently they can learn how to cope with the possible problems.

Teacher learning, therefore, is not viewed as simply translating knowledge and theories into practice, but rather as constructing new knowledge and theories through participating in specific social contexts (Lee& Luft, 2008; Rollnick, Bennett & Rhemtula, 2008) and engaging in particular types of activities (Burns & Richards, 2009). However, a number of challenges may arise due to amplified theoretical knowledge and field terminology, scarcity of deep disciplinary expertise, poor interaction between educators and prospective teachers, scarce reflection on learning, and, as a whole, the inadequate professionalization of PCK. If teaching experience is gained by teaching, prospective teachers need guidance in teacher training process through counseling, observing, and getting or giving feedback in microteaching practices. Narciss (2008) defines feedback as post-response information for a learner on his or her actual state of performance and identifies two types of feedback: external which is peer or teacher-driven and internal that is learner-driven. Teacher-generated feedback to which students respond in a more passive manner and peer feedback into which students are engaged actively through interaction (Yang *et al*; 2006) can be considered very fruitful. The premise of this research paper is therefore to offer new practices through peer feedback and alternative opportunities to help prospective teachers internalize PCK, discuss the gaps, and evaluate themselves.

Theoretical background: Pedagogical Content Knowledge: Shulman (1987:9) defined PCK as teachers' interpretation and transformation of subject-matter knowledge in the teaching context and suggested the key essentials of pedagogical content knowledge: a) knowledge of representations of subject matter; b) understanding of students' conceptions of the subject and the learning/teaching implications that have been associated with the specific subject matter. In Shulman's definition of PCK, the purpose seems to emphasize the dominance of pedagogical knowledge in teacher education. Shulman (1987:14) stresses the existence of pedagogical knowledge of teaching as distinct from subject matter. Pedagogical knowledge is assumed to be the most active component of PCK but it is presumed to be also less controllable and teachable (Liu, 2013). PCK integrates content and pedagogy into an understanding of how particular teaching topics are presented for instruction. Ball and his colleagues (2008) distinguish PCK into two sub-domains: knowledge of content and students, and knowledge of content and teaching. In this respect, in language teacher training programs, the knowledge of language teaching methods, techniques, approaches, teaching strategies, materials development and adaptation, students' needs and expectations, and course and activity designs need to be distinguished as the central domains of content and pedagogy.

A growing body of research has given considerable attention to how PCK has been explored in different subjects (e.g. Abell, 2008; Koçoğlu, 2009; Liu, 2009; Masats & Dooly, 2011; Mitton-Kukner & Murray-Orr, 2015; Park & Oliver, 2008). The studies have contributed a lot to the understanding of PCK applications and professional development. The main concern of those research studies is that PCK as a developmental formation should be initiated in teacher training programs and can be maintained in in-service education. The studies carried out in teaching English as a foreign language (EFL) or English as a second language (ESL) contexts for investigating the PCK development of prospective teachers have offered numerous valuable reflections and suggestions on the topic: for instance, PCK development is considered to be essential for gaining EFL teaching experience (Saraç-Süzer, 2007) and, in a shared manner, EFL teaching experience is considered to be an important source of PCK development (Benegas, 2009). It is therefore suggested that the development of PCK needs to be provided in EFL methodology courses with a satisfactory degree of competency (Atay, Kaşlıoğlu &Kurt, 2010). In other studies by Başer, Kopcha and Özden

(2016) and Koh, Chai, Hong, & Tsai (2015), it is recommended that PCK development should be supported by technology-integrated courses in pre-service teacher education for teaching English. The concern of those studies is that PCK is a supplementary component of EFL or ESL curriculum. Additionally, the topics such as how PCK is gained and developed and how additional opportunities can be provided for expanding PCK should be the focal theme of the research in the field in order to have a deep perception of the PCK argument and to practice alternative ways for educating expert teachers. For such practices, the educator has the chief role while addressing to prospective teachers through PCK and giving feedback when necessary. In expanding PCK, peer feedback as an additional option to the educator feedback can also be considered.

Peer feedback: Peer feedback, whether oral or written, covers the similar focus areas as teacher feedback and has a positive effect on classroom dynamics (Spratt, Pulverness & Williams, 2011). In peer feedback, students make evaluation and judgment about the performance or work of their peers and receive feedback on their performance as well.

Peer feedback research addresses how feedback supports learning through increasing response rate, connecting responses to prior stimuli, validating the previous response, and analyzing learning process (Mory, 2003); and the research suggests that for the effectiveness of peer feedback, the convenient methods of how to provide feedback should be taught to students (Van Steendam, *et al*., 2010). For honest and professional judgments, some suggestions are offered in order to encourage students to give feedback on the specific aspects of the work regarding the purpose of the task, to base their ideas on the professional judgment, to use criteria for confirming holistic judgment for the particular one, to access the implied knowledge of professionals, to be informative for providing learning opportunities, and to engage in peer feedback as autonomous learners (Bloxham, 2013; Brooks, 2012; Carless, 2013; Handley &Williams, 2011; Sambel, *et al*., 2013). These studies discussing the benefits of peer feedback have called for broadening the function, effectiveness, and sustainability of the feedback in the classroom. It is assumed that peer feedback engages students in multiple acts of evaluative judgment and involves them in both invoking and applying criteria to explain those judgments by shifting the control of feedback processes into students' hands (Nicol, Thomson, & Breslin, 2014).

In the literature, by arguing against the conventional feedback practices, a number of studies suggest that teacher feedback by just giving instructions about what is appropriate or inappropriate may not improve learning, and such efforts may not be satisfactory for reviewing what is achieved through teacher feedback (Bailey & Garner, 2010; Orsmond & Merry, 2009; Price, Handley & Millar 2011; Sadler, 2010). The recent models with the emphasis on ongoing peer feedback, instead of the conventional teacher-centered approaches, have been suggested for improving learning (Cartney, 2010; Nicol, 2010). Such feedback has been found to be more facilitative and more comprehensible than teacher feedback in the learning process (Cho, et.al, 2008; Cho & MacArthur, 2010; Falchikov, 2005; Yang, Badger & Yu, 2006). Although peer feedback has been considered to be more functional in the classroom, some studies have also ascertained the benefits of both peer and tutor feedback; for instance, the study by Hamer, Purchase, Luxton-Reilly, & Denny (2015) which attempted to explore the differences in the feedback by tutors and peers under similar conditions concluded that the characteristics of the feedback by both sources showed similarity.

Seeing that peer feedback has been appreciated more encouraging for learners, it may be presupposed that prospective teachers who are expected to be oriented to make the transition from pure theoretical PCK to organize and use that knowledge in teaching practices can also be provided with peer feedback in the training process. However, no studies have directly investigated the impacts of peer feedback for prospective teachers on PCK in teacher training programs. Inadequate established empirical frameworks and attempts in the literature for this kind of collaboration among prospective teachers made it indispensable to search for the impacts of both peer and educator feedback on PCK development of prospective teachers. Therefore, in this present study, the aim was to expose the prospective teachers to the treatment process for a deeper examination of PCK by means of peer feedback and teacher educator interventions.

The present study: The endeavor in the study was to provide an alternative approach through peer feedback in order to expand PCK of prospective teachers and to examine the nature of the feedback, rather than

evaluating whether peer or educator feedback is good or bad. Therefore, the argument in this study was initiated by collecting data from prospective teachers as exam takers about their weaknesses and strengths in PCK with the purpose of lending a hand them to cope with the difficulties and to become more competent in PCK.

Problem: The challenges of PCK development that the prospective teachers of English encountered in the teacher training process were the preliminary problem of this study. For that reason, the prospective teachers' immediate thoughts about the challenges of PCK that were explored by means of think aloud protocols were assumed to be more supportive and authentic to discover the underlying reasons of the difficulties and challenges in PCK.

Participants: The participants of the present study were 81 prospective teachers of English enrolled in the third year of an ELT program at a Turkish university (all third-year prospective teachers who were recruited from two classes of the same department participated in the research). They were taught by the same educator in ELT Methodology I/II courses in which they were exposed to the theory-oriented PCK. All participants were exposed to a consent process wherein they allowed their work to be published. Additionally, because of the experimental nature of the study, ethical and consent procedures with the institution were accomplished. The participants were nearly at the same age level (ranged from 20-to 24) and 89% of the participants were female. It is stated that if the participants in a study are same on a given characteristic, that characteristic is constant, not a variable in the study (Gliner, Morgan & Leech, 2009); therefore, the data were not evaluated according to age and gender differences.

Research questions:

1. What difficulties did prospective teachers of English encounter in terms of PCK?
2. How effective was the feedback on the prospective teachers' PCK achievement in terms of a) educator feedback and b) peer feedback?

METHODOLOGY

In the study, action research as a form of self-reflective and a collaborative act through systematic enquiry that leads to improvement in practices (Herr & Anderson, 2005; Stringer, 2007; Creswell, 2011) was selected to find a solution to the problem and to seek answers to the research questions addressed above. Both qualitative data, think aloud protocols and prognostic exam as introspective procedures to scrutinize the current thought processes, and quantitative data, questionnaire and post-test as retrospective procedures, were used.

The desired outcomes of the action in this study were assumed to be a contribution to the literature in teacher training and to offer a solution to the problem through the collaborative act. The action research protocol was implemented in sequential stages: diagnosing the causes of the prospective teachers' problems in PCK through think aloud protocols; providing peer feedback opportunities as well as educator feedback in PCK as treatment interventions regarding their demands reflected in think aloud inscriptions (planning and taking the action and gathering data); and evaluating the positive and/or negative impacts of the treatment process by means of post-test measurement (evaluation the action). In the diagnostic stage, since think aloud is suggested as a well-established introspective method of data collection in educational assessment and research (Bachman & Palmer, 2010), the prospective teachers as examinees were asked to think aloud and reflect their thoughts about PCK in written mode. The reason of using think aloud protocol during the exam was to explore the decisions they made about the PCK themes and the difficulties they encountered. For each problem, they were also asked to give their own suggestions. The think aloud protocol instructions were presented just above the exam question in the exam papers:

> "In this exam, as you write your responses for the items questioning pedagogical content knowledge, briefly state your thoughts about each related issue in terms of the level of the ambiguity of absolute PCK themes and terminology; reflect your ideas on the clarity and effect of the lecture by the educator in the classroom, and the utility of the resources for understanding and comprehending PCK themes. Add your suggestions for further lectures and applications."

The exam question was:

> "*Are all structures of a language equally open to focus on form? Take your position on the assumption that they are/they are not by giving examples and discuss how you would employ focus on form to teach language universals in terms of the nature of the input in your language classroom? Explain the issue by giving three sample activities."*

The time allocations for the exam was 100 minutes in total, which was offered for both responding the PCK question (50 minutes) and think aloud verbalization (50 minutes). As for the setting of the exam, extra comfort was provided and the prospective teachers were placed in three rooms with relaxed silent atmosphere and sufficient amount of illumination. The exam was administered in the morning session. The participants reflected their views in think aloud format by posting their statements next to the exam item in the written form.

In the study, mixed methods sequential explanatory design which is considered to be highly popular among the researchers (Ivankova *et al*., 2006; Cresswell, 2011) was selected to seek answers to the research questions addressed above.

For detecting the alternative causes of the difficulties, they encountered, whether the source is their academic performance as a whole or not, the participants' grade point average was also documented and described in two categories: 3.00 and above and below 3.00. Of 81 participants, 36 were evaluated as being in the 3.00 and above category (44.4%); the rest were in the below 3.00 category. For data analysis, descriptive statistics was used for calculating frequency, percentage, mean, and standard deviation; in addition, cross-tabulations were conducted for categorical variables; and T-test and Mann-Whitney U Test were calculated to verify the distribution of the variables as parametric and non-parametric counterparts (Büyüköztürk, 2006).

FINDINGS AND RESULTS

The introspective methods: Think aloud protocols and prognostic exam: Since the number of the participants was relatively high, an exam session was used for employing the think aloud protocol. Although think aloud procedures are typically conducted orally and applied on small number of participants presumably because of expensive and time-consuming aspect of the procedure (Johnson, 1992; Pressley & Afflerbach, 1995), think aloud data in this study were gathered in written form so as to access sufficient number of documents for drawing legitimate conclusion. It is suggested that think aloud protocols do not have to take the form of merely oral response; students can also write think aloud comments on a paper (Caldwell, 2008; Bachman & Palmer, 2010) so that educators can find suitable and more time to examine and compare with those of peers.

The think aloud protocol instructions were presented just above the exam question in the exam papers. For analyzing 81 recordings in the exam session, a total number of 221 written comments (about 2.7 per participants) were documented by the researcher initially. The similar and diverse statements were included into the relevant category. The categories that were initially sorted by the researcher were coded collaboratively by two raters. The codes of the two raters were measured through Cohen's Kappa, and inter-rater agreement ($K_{221=}$.93) was achieved. The coded items were sorted out in 14 categories and displayed in Table 1.

Table 1. The categories of think aloud.

Categories of PCK difficulties	F	%
Comprehending the terminology	34	15.3
Applying methods/techniques	23	10.4
Designing lesson plans	14	6.3
Achieving teaching skills	11	4.9
Accessing theoretical content knowledge	33	14.9
Developing instructional strategies	17	7.6
Ambiguity in field knowledge	21	9.5
Figuring out pedagogical practice	9	4.0
Problem-solving	16	7.2
Noticing the knowledge gap	10	4.5
Lacking pedagogical simulation	11	4.9
Sorting out professional behavior	8	3.6
Collaborating with educators	5	2.2
Designing teaching activities	9	4.0
TOTAL	221	100.00

As Table 1 indicates the largest proportion and frequency of PCK difficulties declared in the think-aloud protocols were terminology comprehension, figuring out and accessing ambiguous content knowledge, and selecting and applying suitable teaching methods. Problem solving, developing teaching strategies, designing lesson plans for teaching language skills, and lack of pedagogical simulations were categorized at moderate level difficulty. The other categories were at a lower level of difficulty. Some examples of the raw data are displayed below to reflect what the participants said:
Think aloud statements:

"……while combining the terms into the discussion, I am not capable enough…" (terminology comprehension).

"I think I cannot interrelate language universals with focus on form…" (accessing theoretical content knowledge)

"…I cannot figure out how to respond…I can explain the focus on form separately…" (noticing the knowledge gap)

"…in the course, I had difficulties while comprehending the concepts…I studied with my friends, and thus, I could understand…" (collaborating with the educator)

"…the term 'language universals' is easy to define…I am not sure whether I can design suitable activities…" (figuring out pedagogical practice)

"When I study, all topics seem too theoretical…my friend explains and I can comprehend the notions with no trouble…" (sorting out professional behavior)

"…I don't know what contribution such knowledge makes to my teaching practice…" (designing teaching activities; lacking pedagogical simulation)

"I always study with my friends before the exams and we try to exemplify each term collaboratively…when I am alone, I think I am not so capable as with my friend, so I could not interrelate the terms in a context but I did my best in the exam…" (ambiguity in the field knowledge; comprehension; problem-solving)

The documented think aloud protocols reflected similar thoughts and most of the participants (79%) persistently emphasized the difficulty of comprehending the terms which were too theoretical and abstract for them and the ambiguity of the educator's academic language use; and they insistently claimed they could not use PCK terms and themes in practice. In the direction of the prospective teachers' statements and expectations, they were also asked to declare their suggestions in the think aloud claim for finding solutions. In the suggestions component, instead of getting PCK input merely from the educator, they suggested discussing the topics and the terms with their classmates during the course time for giving and getting feedback each other under the control of the educator. Few offered to carry out team projects in order to work collaboratively and share knowledge. Regarding their suggestions, a five-week treatment process was designed for each class separately.

Treatment process and peer feedback: In the treatment process, the educator lectured the topic and presented the theoretical issues at the beginning of each course session. Following the lecture, the prospective teachers were exposed to discussion sessions in which they were asking questions each other about the PCK topics and how to implement the related theoretical issues in practice by sharing their previous school experiences, their previous teachers' manners, and their present experiences. Additionally, during the class time, fifteen-minute discussions on PCK were held for giving and getting feedback so as to assist them to cope with the ambiguous academic language use and difficult terms. By observing and evaluating the ongoing sessions, the educator also gave feedback when necessary. They insistently used mother tongue while explaining the issues, but through inserting, namely code-switching, the PCK terms in English. When they failed to explain the issue appropriately, the educator assisted them to convey the information.

Furthermore, during the treatment process, they prepared lesson plans and practiced micro teaching sessions. The lesson plans were evaluated by the peers and assessed through written or oral feedbacks. In microteaching sessions, they cautiously observed each other and questioned the activities by giving feedbacks. As feedback research indicates (Bloxham, 2013; Brooks, 2012; Carless, 2013), the peer feedback (PF) was used as an important alternative to the educator feedback (EF) for enhancing their learning. The educator behaved as a controller and observer during those sessions and lent assistance when necessary. The educator continued to provide feedback on the missing points. During the treatment process, they took a quiz which was used as the formative assessment with the peers' reviews as an

alternative to face to face feedback in the classroom. The written reviews and feedback from the peers were used to support the oral feedback.

Post-treatment process -Retrospective methods

The questionnaire: To gain a deep understanding of the feedback experience, the participants were surveyed after the treatment process by means of a questionnaire developed by the researcher. Instead of using existing instruments for evaluating the participants' feedback perceptions, the researcher designed the questionnaire for this research, because the existing ones do not focus on peer feedback within the PCK context. The content validity of the survey was established by assessing the content of the thoughts addressed in the think aloud reports by the participants. In the survey, they were questioned about their perceptions of the peer feedback/educator feedback in terms of empowerment, the quality of content knowledge, lucidity of the information, professional support, comprehensibility of terminology, trustfulness of the information, frankness of the peers while giving feedback, the nature of professional consciousness, and problem-solving.

Initially, the questionnaire was piloted for calculating the Cronbach's alpha internal consistency, α= .80. For piloting the scale, eight respondents were randomly drawn from the fourth year prospective teachers who had attended the course previously at the same department and lectured by the same educator. The reason why the respondents were not drawn from the sample was that all third year prospective teachers should have been exposed to same treatment in order not to fall behind the class, as the action research was conducted in the ongoing education process. The survey items were designed as consistent with the PCK course contents and the results are displayed in Appendix I.

The overall finding from the survey was that the prospective teachers of English agreed on the positive impact of PF in terms of gaining PCK. Most reported PF was motivating for the teaching profession as a whole. The strengths of PF were mostly on the comprehensibility of teaching methods and PCK terminology, gaining insights on teaching assessment, developing instructional strategies, analyzing theoretical PCK, increasing confidence in problem-solving, clarifying ambiguity through receiving and giving feedback, collaborating, and noticing the gap. However, they also found some aspects of EF contributing more than PF in terms of gaining professional behavior, verifying learner differences, contribution to teaching proficiency, and professional development. In some aspects, the responses denoted the constructive assistance of both PF and EF as relatively identical opportunities for using pedagogical simulations, gaining skill-based knowledge, getting the experience of congregating various pedagogical practices, and designing lesson plans.

Further, those items addressing to PF and EF effectiveness were grouped in the PCK theme sets to make clear interpretations of the aspects in terms of their strengths and weaknesses. A review of the comments was reevaluated by means of cross-tabulation to ascertain the relative proportion between the two types and displayed in Table 2.

Table 2. EF and PF impact Cross-tabulation.

Feedback theme	Impact of the feedback			Educator	Peer	Total
				EF	PF	
Instructional strategies	Comprehensible justification	Strongly agree	Count % Within groups	24.3	30,1	54,4
		Agree		35.4	39,3	74,7
		No idea		10,2	15,5	25,7
		Disagree		14,3	10,4	24,7
		Strongly disagree		15,8	4,7	20,5
	Total			100,0%	100,0%	
Academic language use	Clear and lucid Explanation	Strongly agree	Count % Within groups	45,1	36,8	81,9
		Agree		29,5	45,1	74,6
		No idea		13,7	12,3	26,0
		Disagree		29,3	4,7	34,0
		Strongly disagree		11,7	1,1	12,8
	Total			100,0%	100,0%	

Continue Table 2.

Developing activities	Directive data	Strongly agree	Count % Within groups	20,8	37,5	58,3
		Agree		39,9	35,8	75,7
		No idea		17,6	10,6	28,2
		Disagree		15,5	8,7	24,2
		Strongly disagree		7,2	7.4	14,6
	Total			100,0%	100,0%	
Professional consciousness	Intelligible details	Strongly agree	Count % Within groups	11,1	22,5	33,6
		Agree		24,9	53,1	78,0
		No idea		20,7	12,1	32,8
		Disagree		40,3	10,0	50,3
		Strongly disagree		3,0	2,3	5,3
	Total			100,0%	100,0%	
Problem solving	Constructive opinion& reasonable decision making	Strongly agree	Count % Within groups	9,1	35,6	44,7
		Agree		36.8	46,9	83,7
		No idea		15,6	5,5	21,1
		Disagree		26,4	10,2	36,6
		Strongly disagree		12,1	1,8	13,9
	Total			100,0%	100,0%	

A very high proportion of the participants declared that PF was more contributing to PCK in all theme sets, though EF also had comparable values: comprehensible justification (EF=59.7%; PF=69.4%), clear and lucid explanation (EF=74.6%; PF=81.9%), and directive data (EF=60.7%; PF=73.3%). In the other theme sets that cover intelligible details for professional consciousness (EF= 36.0%; PF=75.6%) and constructive and reasonable feedback for problem-solving (EF=45.9%; PF=82.5%), the highest values were assigned to PF.

To scrutinize the impact of PF and EF on the participants at different GPA levels, the Mann-Whitney U Test was conducted and a summary of the findings is presented in Table 3.

Table 3. Impact of PF and EF on the participants at different GPA levels.

Feedback theme for PCK	GPA	N	Mean rank	Sum of ranks	U	P
instructional strategies	3.00 and above	36	86,70	3121,2	433,000	0,34
	Below 3.00	45	71,02	3195,9		
academic language use	3.00 and above	36	79,45	2860,2	356,000	0,24
	Below 3.00	45	69,36	3121,2		
developing activities	3.00 and above	36	82,40	2966,4	324,000	0,32
	Below 3.00	45	64,34	2895,3		
Professional consciousness	3.00 and above	36	63,25	2277,0	312,500	0,22
	Below 3.00	45	60,25	2711,2		
Problem solving	3.00 and above	36	60,42	2175,1	309,000	0,00
	Below 3.00	45	61,40	2763,0		

The impact of both PF and EF on the prospective teachers in the 3.00 and above category of GPA was found to be useful in all PCK theme sets, but the difference is not so significant. However, for the ones in the below 3.00 category, the impact of PF and EF on instructional strategies ($\bar{X}$ =86.70), developing activities ($\bar{X}$ =82.40) and academic language use ($\bar{X}$ = 79.45) was noteworthy. The effect size was calculated and the value was found to be large, d= 1.17 (according to Cohen (1988), d<0-0.02 is weak; 0.21<d<0.50 is modest; 0.51<d<1.00 is moderate; 1<d is strong effect).

During the post-treatment process, another data set was gathered for checking the prospective teachers' preferences about the feedback as further data. In this data set, it was aimed to obtain the prospective teachers' reflection on the action in order to design and continue the repetitious action cycles for further courses. The findings are displayed in Table 4.

Table 4. Participants' perceptions of feedback aspects (n=81).

The aspects of feedback shaped learning	Always		Often		Sometimes		Never	
	N	%	N	%	N	%	N	%
Giving feedback to peers	42	51,8	36	44.4	3	3.7	-	-
Receiving feedback from peers	47	58,0	34	41,9	-	-	-	-
Giving and receiving feedback	55	67,9	26	32,0	-	-	-	-
Feedback from educators	30	37,0	37	45,6	14	17,2	-	-
Oral feedback	56	69,1	25	30,8	-	-	-	-
Written feedback	33	40,7	26	32,0	22	27,1	-	-
Negative feedback	27	33,3	22	27,1	17	20,9	15	18,5
Positive feedback	39	48,1	42	51,8	-	-	-	-
Private feedback	34	41,9	18	22,2	26	32,0	3	3.7
Public feedback	27	33,3	27	33,3	14	17,2	11	13,5
Immediate feedback	32	39,5	16	19,7	25	30,8	8	9,8
Delayed feedback	11	13,5	9	11,1	35	43,2	26	32,0
Theoretical perspective	42	51,8	35	43,2	4	4,9	-	-
Practical perspective	39	48,1	33	40,7	9	11,1	-	-
Clarity	78	96,2	2	2,4	-	-	-	-
Justice	21	25,9	22	27,1	36	44,4	2	2,4
No feedback from peers	-	-	2	2,4	27	33,3	51	62,9
No feedback from educators	-	-	9	11,1	38	46,9	34	41,9

The prospective teachers reflected equally on the significance of both giving and receiving feedback. Relatively, both educator feedback and peer feedback were thought to be essential during the education process. In terms of the mode of the feedback, their preferred both oral and written feedback. They preferred dominantly positive feedback, while some (nearly 60%) had a preference for negative feedback as well. As for public or private feedback preferences, the percentage levels were distributed equally. They mostly preferred immediate feedback rather than delayed feedback. Their preference was also for both theoretically and practically driven feedback. For the quality of the feedback, all preferred receiving clear and truthful feedback at any case either from peer or educator.

Achievement exam: As the last stage of the process, a final exam on PCK, which was used as a retrospective tool for the post-test assessment, was administered to discover whether the prospective teachers' achievement level in PCK increased after the feedback treatment. The final exam, as similar to the prognostic exam, was designed by considering the issues in PCK (Appendix II). Table 5 displays the findings calculated by means of *t*-tests to compare with the grades of the pre-test and post-test.

Table 5. Pre-test and post-test PCK scores.

Group	N	$\bar{X}$	S	df	t	P
Pre-test	81	48,32	14.06	80	-25.62	.000
Post-test	81	80,70	22.78			

The difference between pre-test and post-test is statistically significant, t (80) = -25.62, p<.01. The post-test means of the prospective teachers ($\bar{X}_{\text{post-test}}$= 80.70) was found to be higher than the pre-test means ($\bar{X}_{\text{pre-test}}$= 48.32). The effect size was calculated and the value was found to be quite large, d= 2.06 (according to Cohen (1988), d<0-0.02 is weak; 0.21<d<0.50 is modest; 0.51<d<1.00 is moderate; 1<d is strong effect).

DISCUSSION

In this study, the PCK intricacies the prospective teachers of English encountered in the teacher training process were scrutinized by both introspective and retrospective research methods. The results of the study

will mainly be discussed around the research questions. The answers to the first research question "What difficulties did prospective teachers of English encounter in terms of PCK?" were sought through think aloud protocols in written form during the PCK exam for diagnosing the potential problems of the prospective teachers. The think aloud protocols in the written form made it available to access many participants at once and to offer them a wider space to reflect their thoughts on the issue. The prospective teachers made reference to similar difficulties they encountered, mainly PCK terminology, the ambiguity of theoretical knowledge, lack of professional efficacy, and so on. Therefore, most of the participants determinedly suggested to get peer feedback on the PCK, particularly on the PCK terms, due to the complexity of the educator's academic language use and the ambiguity they faced while comprehending too theoretical and abstract terms. They suggested that the PCK terms and topics would be more clear and comprehensible when they discussed with their classmates under the control of the lecturer. With regard to their suggestions, peer feedback interventions through collaborative discussions for PCK were implemented during the treatment stage of this study. In this respect, this study might be a sample for further studies to evaluate the effectiveness of peer feedback in teacher training programs, since such feedback type for PCK has not been the concern of the previous studies carried out on the effectiveness of peer feedback.

The answers for the effectiveness of the feedback -the second question- were sought through surveys. The results from the survey indicated that the prospective teachers benefited mostly from their classmates' feedback in terms of motivation, comprehensibility of PCK, collaboration and problems solving issues, while educator feedback was also appreciated by them. Thus, feedback both from the peers and the educator could be facilitating for noticing the gap, gaining professional behavior, proficiency and professional development, and finding solutions to the possible problems.

The findings of the present study supported the findings of the previous studies about the benefits of peer feedback, but in a different context. The overall outcome displayed that receiving or giving peer feedback on the PCK themes was encouraging for gaining competency on the PCK, but in few respects not better than educator feedback. As consistent with the previous studies, e.g. by Bloxham (2013), Carless (2013), in this study, peer feedback was found to be an important alternative to the educator feedback for supporting learning. The results are also in line with the studies carried out by Falchikov (2005), Cho, et.al (2008), Cho and MacArthur (2010) that mainly focused on facilitative and comprehensible aspects of peer feedback. Thus, it may be expected that by getting feedback from peers, they could support each other to find solutions to the ambiguities and difficulties in a more self-directed and autonomous attitude as stated by Spratt and his colleagues (2011). Additionally, it may also be supposed that collaboration among the peers and the educator to cope with the difficulties might have encouraged them to reflect their PCK in a self-assured way, since the prospective teachers were more conscious about the PCK themes in the post-test. Moreover, the findings indicated that both successful and less successful prospective teachers benefitted from peer feedback and educator feedback on the PCK themes. On the other hand, the study results displayed divergent findings from the studies in which negative attitudes of the students toward peer feedback applications were detected; for example, Kaufman and Schunn, 2011.

Since feedback is claimed to be more fruitful when conceptualized as a dialogue rather than as a one way transmission process (for example, Nicol, 2010), the same strategy was pursued in the five-week collaborative discussion process in this study. As indicated in the think aloud protocols, the difficulties pertained to terminology comprehension made it very hard for the prospective teachers to decipher the meaning of the term in content knowledge; therefore, peer feedback as a dialogue between the peers assisted them to highlight the ambiguous points during the simultaneous discussion sessions and prompted their PCK development. Furthermore, using mother tongue while discussing also helped them declare their ideas in a lucid way. Additionally, as Cho and his colleagues (2008) emphasized, when the peers stated their comments about the themes, they used the similar language style (either in Turkish or English) without professional jargon. In other words, the clarity and comprehensibility of the peer feedback was the most shared idea among the prospective teachers.

Feedback research also touches upon how to direct participants for honest and professional judgments in order to access the implied knowledge (Brooks, 2012; Handley &Williams, 2011; Bloxham, 2013; Carless,

2013), and the same policy was the main concern in the treatment process of this study. The prospective teachers participated in the process enthusiastically and tried to give feedback in a faithful manner.

Depending on the results of this study, some suggestions can be offered for further research. First of all, while evaluating the performance levels of examinees, the potential causes of exam results need to be investigated for a deeper understanding and finding solutions through some introspective methods like think aloud, rather than presenting brief comments about exam results in terms of success and failure or numerical grades; because think aloud is acknowledged as a well-established introspective method of data collection in educational assessment and research (Bachman & Palmer, 2010). There are a number of other strategies for think aloud offered in the literature; for example, through questionnaire (Akyel,1997); videotaping (Sugirin, 1999); observing body language (Fontana & Frey, 2000); marking up examination scripts (Suto &Greatorex, 2008). These strategies may be facilitative for investigating the intricacies of students and prospective teachers in educational settings in order to determine the potential problems and offer assistance for finding solutions to the problems. The written mode of the think aloud used in this study may also be offered as a sample model for the research literature in the field. The significant aspect of this mode is to congregate large samples of ideas through think aloud protocols in written form and to examine how think aloud protocols could be used to gather examinees' ideas on the exam questions. It was also presumed that the written mode of the think aloud procedure might make the prospective teachers feel themselves more self-directed to think about the issue.

Another significant side of this study also lies in an innovative feedback treatment type which is peer feedback through collaborative discussion among prospective teachers for the PCK themes. This aspect of the study seems to bring about novel ideas to the field and contribute to the relevant literature. In this respect, the study might be helpful for both prospective teachers and educators. This study is limited with the investigation of the impact of the peer feedback and educator feedback relatively on the academic achievement of the prospective teachers. For further research, the socio-emotional aspect of the feedback from peers or educators needs to be investigated. Moreover, academic experience of participants, either students or prospective teachers, is another factor that should be correlated while searching for the effectiveness of the feedback.

CONCLUSION

This study addressed the challenges of the PCK from the perspectives of the prospective teachers of English and attempted to implement think aloud protocols in an exam session in order to access a large number of participants at once. The outcome was found to be convincing. An additional attempt which was made to find solutions to those challenges regarding their suggestions in the think aloud claims yielded optimistic probabilities of using peer feedback as a collaborative discussion activity among prospective teachers for developing PCK. The attempts for a combination of both introspective and retrospective research methods to collect and scrutinize the data were encouraging for offering innovative suggestions to the field. The present treatment as a model for prospective teachers might also offer further suggestions for them to use those methods in their professional lives as teachers.

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Appendix I. The questionnaire about the PCK course contents.

	Feedback (Peer Feedback: PF/ Educator Feedback: EF)		Strongly agree	Agree	Undecided	Disagree	Strongly disagree	$\overline{x}$	SD
1	was motivating for my teaching profession	PF	36.8	47.4	14.0	1.8	-	4.36	0.67
		EF	21.1	30.4	36.3	9.2	3.0	3.61	1.10
2	helped me to design my lesson plan	PF	5.3	49.1	43.9	1.8	-	3.54	0.95
		EF	7.0	60.9	26.8	5.3	-	3.99	0.93
3	was comprehensible for teaching methods /techniques	PF	17.5	52.5	10.2	16.3	3.5	4.28	0.98
		EF	-	10.5	38.6	50.9	-	1.70	1.18
4	was helpful for comprehending terminology	PF	7.3	60.0	27.0	5.7	-	4.07	0.69
		EF	16.3	30.9	22.3	30.5	-	3.31	1.15
5	prompted my teaching performance	PF	33.3	47.4	19.3	-	-	4.35	0.65
		EF	50.9	26.3	12.3	10.5	-	4.49	0.59
6	contributed to my teaching proficiency	PF	-	57.9	14.0	21.1	7.0	3.67	0.92
		EF	33.0	41.5	19.2	6.3	-	4.30	0.77
7	helped developing appropriate instructional strategies	PF	40.2	42.2	9.3	7.0	1.3	4.35	0.66
		EF	3.3	17.7	11.6	51.6	15.8	2.20	1.10
8	were productive in terms of intelligibility	PF	29.1	52.5	9.8	17.5	-	4.43	0.59
		EF	-	32.5	19.0	31.1	17.4	2.91	1.06
9	was constructive in terms of teaching assessment	PF	15.8	61.4	14.8	6.8	1.2	4.07	0.73
		EF	8.8	32.1	27.5	31.6	-	3.13	1.14
10	fostered congregating various pedagogical practices	PF	24.3	52.9	12.5	10.3	-	4.32	0.64
		EF	26.3	42.9	10.0	11.7	10.0	3.61	1.10
11	was supportive to analyze theoretical content	PF	56.3	43.7	-	-	-	4.83	0.49
		EF	-	51.6	41.4	1.8	5.3	3.54	0.94
12	was favorable for my future occupation	PF	21.0	32.2	23.3	23.5	-	3.40	1.21
		EF	24.7	44.0	19.0	12.3	-	4.15	0.85
13	was encouraging for problem-solving	PF	15.5	50.8	9.8	22.1	1.8	4.23	0.98
		EF	-	31.8	3.8	32.6	31.8	1.32	1.29
14	gave confidence in terms of declaring my suggestions	PF	74.0	24.3	1.7	-	-	4.78	0.56
		EF	12.3	25.3	-	26.3	36.1	1.85	1.22
15	was effective to clarify the ambiguity	PF	46.3	44.4	-	9.3	-	4.36	0.67
		EF	10.4	21.0	7.3	60.0	1.3	1.88	1.16

16	was stimulating to notice the gap	PF	82.0	18.0	-	-	-	4.81	0.52
		EF	21.9	11.1	12.3	30.4	24.3	1.62	1.15
17	was informative about skill-based knowledge	PF	64.7	32.3	3.0	-	-	4.47	0.72
		EF	40.4	52.6	5.3	1.7	-	4.77	0.54
18	gave opportunity of how to verify learner differences	PF	20.0	18.4	-	45.0	16.6	1.90	1.24
		EF	26.3	42.9	10.2	11.5	10.0	3.61	1.10
19	forced me to search for the topic	PF	20.4	72.6	5.2	1.8	-	4.71	0.51
		EF	1.7	3.2	27.4	67.7	-	1.87	1.16
20	helped me use pedagogical simulations in education	PF	21.1	30.4	36.3	9.2	3.0	3.61	1.10
		EF	22.3	32.9	11.3	33.5	-	3.31	1.15
21	taught me how to obey professional behavior	PF	7.4	20.6	19.0	45.4	7.6	2.10	1.09
		EF	41.0	59.0	-	-	-	4.85	0.43
22	provided opportunities for collaboration	PF	73.0	25.3	1.7	-	-	4.78	0.56
		EF	21.9	21.1	2.3	30.4	24.3	1.62	1.15

Appendix II Post-test

1. Interaction with students in the classroom frequently includes confirmation checks, comprehension checks, clarification requests, and feedback. How would you boost learner generated attention to form through these interaction types? Exemplify each type.
2. Create an activity to verify the teaching of “relative clauses” to adult learners by the use of enriched input to implement cognitive objectives in the course.
3. What do you think, in your own experience, about the assistance of background elements of a lesson plan during teaching process?