Redesigning Effective Methods Courses: Teaching Pre-Service Teachers How to Teach

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Abstract

The current study investigates the expected roles of mentor teachers, practice schools, and associated faculty members via students` opinions regarding practicum courses such as field experience and teaching practices. In particular, it is designed to explore how practicum courses (methods courses, student teaching, school experiences, and teacher application) currently work and how they should be used to enhance pre-service teachers` experiences prior to their graduation. Raising pre-service teachers` practical knowledge and experiences as regards professional development is considered to be one of the main goals of schools of education around the world. Preparing them involves several factors including a mentor teacher, faculty members, selected schools, and more importantly a teacher preparation program by means of field experiences. Such factors were particularly examined to boost pre-service science and maths teachers` knowledge and experiences in teaching science and mathematics as well as to prepare them for actual learning environments. For this purpose, a total of 164 pre-service teachers, 81 science and 83 mathematics education students, were enrolled in their last semesters in teacher preparation programs, and their mentor teachers and associated faculty members were selected to explore the research questions. A mixed methodology was purposefully utilized to gather the necessary data via questionnaires, interviews and school records. The results of data analysis revealed that according to students` field experiences some revisions in the professional development program are necessary to prepare pre-service teachers for the actual educational system and school settings.

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Abstract

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Introduction

Various elements and structures of field experiences are known as the sine qua non of teacher preparation programs because they connect university methods courses and actual teaching experiences in more informal collaborations for the benefit of pre-service teachers (Abell, 2006, Book, 1996, Goodlad, 1991; Shoyer, 1996; Teitel, 2000). Preparing teacher candidates for the actual teaching environment has always been a worthwhile goal, in the history of teacher preparation programs since the beginning of professional developments; this has been especially so in the last 25 years of teacher education programs. Several reform documents (American Association for the Advancement of Science (AAAS), 1993; National Research Council (NRC), 1996, 2000; Project 2061, 1989; National Science Teacher Association (NSTA), 1984; Carnegie Forum, 1986; Committee on Science and Mathematics Teacher Preparation, 2001; Holmes Group, 1990; National Commission for Excellence in Teacher Education, 1985) report that teacher training programs should emphasize pre-service teachers` field experiences via inquiry-based teaching activities such as hands-on science activities in order to promote PSTs' practical implementations of theoretical concepts towards actual science teaching.

Similar teacher preparation programs, methods courses, and field experiences were designed for the sake of teaching training programs the schools of education around the world. Particularly, in order to improve pre-service teachers` knowledge and experiences about actual classroom teaching, several colleges offer such methods courses They also make obligatory planned field courses that demand the rational vision of superior education widely accepted as a proper approach by teacher educators, PSTs, and school-related colleagues (Abell, 2006). For instance, the Missouri Department of Elementary and Secondary Education (2002) implemented new innovative approaches and ideas under the title 'learning on the job'. In general, methods courses that include field experiences are offered at the beginning of teacher preparation programs to force students to start thinking like a teacher and let them consider if the career of teaching fits their career choices (Abell, 2006). Abell (2006) continue through to the end of the education programs with more emphasis during junior and senior semesters. They identified many important challenges to the science methods field experience: logistical and institutional challenges, supervision challenges, and challenges to teacher learning. In addition, four types of models are outlined that can be applied in order to make teacher field experiences more

beneficial: the virtual field experience, the add-on field experience, the partner's model, and the field experience block.

Methods courses are generally designed to help PSTs to develop their pedagogical content knowledge (PCK) and to apply their theoretical conceptions of teaching science according to a reform basis. For example, according to the Association for the Education of Teachers in Science (AETS) mission statement, science teachers should possess six main professional knowledge standards: 1) knowledge of science; 2) science pedagogy; 3) curriculum/instruction/assessment; 4) knowledge of learning/cognition; 5) research/scholarly activity; 6) professional development activities (AETS, 1997). The first two are perceived as the academic knowledge gained in the first two years of teacher preparation programs, mutually taught in initial educational history, philosophy, and other theoretical content courses. The last two are usually obtained via professional development and methods courses. Teacher candidates foster academic and professional development activities during their actual teaching activities, especially scaffolding in the first five years, as a lifelong learning experience. Therefore, more emphasis should be placed on the design, content, and process of methods courses in science and mathematics education.

A typical methods course including field experiences consists of mentor teacher observations, preparing a portfolio of the field experience, teaching with the help of a mentor teacher and alone, and getting familiar with the education system, rules, and school environment. The teaching part of the course seems to be the most important duty of PSTs pertaining to their academic developments. They usually spend 1/3 of the semester equally in classroom observations, teaching a under mentor teacher's supervision, and teaching alone. Nonetheless, sometimes, exceptions do occur: for example they might teach alone for half of the semester. This depends on the mentor teacher, faculty member, and school administration. In terms of the effectiveness of methods courses and field experiences, McInytre, Byrd & Foxx (1996) showed that the contributions of these field experiences remain unclear. Similarly, with regard to the complex nature of effective teaching, Schulman (1986, 1987) pointed out seven important features that an effective teacher should possess. Three of these are known as content knowledge, general pedagogical knowledge, and pedagogical content knowledge. Fostering pedagogical content knowledge (PCK) is another essential characteristic that prospective teachers should start building by the end of the teacher preparation programs. Several studies investigated PCK in terms of its applicability to science and mathematics perspectives and how it should be constructed (van Driel, Verloop, & de Vos, 1998; MaKinster, 1999). PCK is commonly defined as "altered content knowledge by the teacher into a structure that makes it reasonable to students" (Schulman, 1987). In another definition, "PCK is the integration or synthesis of teachers' pedagogical knowledge and their subject matter knowledge." (Cochran, 1999). Therefore, promoting science PCK requires learning experiences and implementing various types of utilizing hands-on materials including teaching in real classrooms settings.

On the other hand, few studies have investigated experimental or action research pertaining to field experience courses. For example, Hudson and Brooks (2005) developed an instrument related to mentoring for effective primary science teaching and proposed an evaluation tool to measure final year PSTs' perceptions. They identified five key factors resulting in effective mentoring in science teaching: personal attributes, system requirements, pedagogical knowledge,

modeling, and feedback. The survey instrument consists of 45 Likert-type statements related to students' final professional school experience that are answered with a five choice rubric of strongly agree to strongly disagree. In a different study, Mewborn (1999) investigated pre-service mathematics teachers' perceptions of classroom observation during their practicum courses and sought to explore problematic aspects of the teaching-learning environments in field courses. In conclusion, some suggestions were made for teacher educators: for example they should create learning opportunities for teacher candidates via reflective thinking and particularly Dewey's five phases of the reflective process. For a field application of the above study, Hudson and McRobbie (2003) conducted an experimental study with a control group of final year pre-service teachers (N=60) and an intervention group of 12 final year pre-service teachers. The PSTs were exposed to five mentoring factors (personal attributes, system requirements, pedagogical knowledge, modeling, and feedback) during a four-week professional program. Their statistical results indicated that the intervention group achieved more mentoring experiences. In addition, the authors claimed that specific mentoring intervention has the potential to boost the quality of pre-service teacher, teaching experiences.

In another experimental study, Gurel *et al*. (2002) examined how pre-service students evaluate and conceptualize a sample lesson on a physics topic when they are confronted with one. They were then asked to fill in observation questionnaires about it. In addition, they were asked about their views on such methods courses in terms of their effectiveness to prospective teachers' approaches in science teaching in actual classrooms. As a result, the authors found that most prospective teachers did not recognize or evaluate sample lessons efficiently. It was found that teacher candidates internalized science methods courses and believed that such methods courses and related field experiences explicitly affected their conceptual understandings and process of forming their pedagogical content knowledge (PCK).

Similar studies have been conducted to explore the curriculum and field experience applications and perspectives of pre-service students, faculty members, and mentor teachers in science, or other disciplines, methods courses (Turgut et al., 2008; Aydin et al., 2007; Aksu & Demirtas, 2006; Ergunes, 2005; Kalyoncu & Sazak, 2006). Findings revealed that pre-service teachers believed that they put a lot of effort into their field experiences but mentor teachers and faculty members did not demonstrate enough collaboration during the program. Another problem stems from the lack of teaching materials in schools for classroom demonstrations and activities and this restricts PSTs from illustrating their potential. Faculty and school relations remained another source of contention. Faculty members were deemed as not spending enough time in guiding teacher candidates because of over heavy course loads. Some recommendations to promote field experiences included increasing the motivation of students via effective faculty-school collaboration; clarification of the process and documents utilized; offering separate courses and seminars to student teachers and graduates as well as to school administrators; selecting mentor teachers with a better academic background (Master's degree and above); and increasing the number of hours for observation and teaching.

As to the need for the aforementioned activities in teacher preparation programs, this study is designed to concentrate more on the roles of mentors, and on students` opinions about the methods programs in different practicum courses in teacher preparation programs; it also aims to explore how they work and how they should be used to enhance pre-service teachers` (PST)

experiences through methods courses and student teaching. Increasing pre-service teachers` knowledge and experiences with regard to professional development is considered to be one of the main goals of schools of education around the world. The above-mentioned goals were examined through detailed evaluations of the perspectives of science educators, mentor teachers, and PSTs. Specifically, this study was guided by the following research questions:

1) How do PSTs' opinions in mathematics and science education departments differ regarding methods courses?
2) Are methods courses' contents and implementation effective in the teacher preparation programs according to PSTs and their mentor teachers?
3) How can methods courses be revised to enhance students' preparedness for their actual teaching duties?

Methodology

The university in which data were collected is a mid-size research institution situated in the central region of Turkey. All of the participants in this study hold Turkish nationality and demographic distributions slightly vary as some of them come from the western part of the country. It offers a 4-year undergraduate teacher preparation program which includes two practicum courses (school experience and teaching practice), one consisting of 14-week teacher observation sessions and the other consisting of 4 weeks of observation and 10 weeks of student teaching. Every week throughout the "School Experience" course students spend one and four contact hours with on education faculty teacher and mentor teacher (class participation, observation) respectively. Similarly, in the following course 'Teaching Practice', they spend one and six contact hours with a faculty and mentor teacher (Higher Education Council, 2006). These courses are offered in the senior year in teacher preparation programs. The Turkish K-12 education systems were restructured in 2005 and a constructive approach was aimed at all grades for teacher preparation programs, curriculum reforms, and textbooks.

Teacher candidates enrolled in the elementary grades, (K-5) teacher preparation programs are required to prepare portfolios at the end of both courses. Students are enrolled in certain specialized majors of the elementary science and mathematics education programs. In this study, PSTs had already taken the school experience course in an earlier semester and were taking the field experience (student teaching) course at the time of the study. The second course also includes observation evaluations conducted by each student's mentor teacher and an education faculty member. Students participating in these sessions take two science methods courses each semester in their junior year. These courses consist of the philosophy of education, educational theories, education systems, methodology, and the history of education, and are concluded with microteaching sessions, with longer teaching sessions in the latter course. PSTs choose a topic in the elementary science/maths education curriculum at the beginning of the course. They are allowed to use any instructional techniques and teaching tools they wish. They teach their topics for 15-20 minutes to a small group of students (N=30) and the class spends five minutes for questions. Faculty members' evaluations are based on four factors: introduction, teaching approach, presentation of materials and evaluation. Although they present microteaching in the classrooms, it inadequately reflects many features of actual classroom settings such as real students, duration of the lesson, and use of materials.

The mentor teachers of the PSTs involved in the study are illustrated below according to four categories by gender and length of service with 0 to more than 15 years of experience. Mentor teachers were, in general, purposefully selected from nearby, cooperating K-12 schools by the faculty of education using certain criteria including academic eligibility, personal willingness, and prior experience in student teaching programs. They graded teacher candidates in terms of their instructional abilities and development of necessary professional requirements (e.g. classroom management). Faculty members working with mentor teachers also observed PSTs at least twice during their fieldwork and graded them via a 40-item evaluation form. The student then, received a grade of their average scores. An attendance rate of 80% in the mentor teachers' classrooms is also a course requirement. Students may fail if they cannot meet the requirements. They also prepare a portfolio for the faculty members and meet with them once a week and discuss any problems that might emerge.

The total number of male science teachers who participated in the study was slightly higher than that of female science teachers. Concerning their teaching experiences, most of the science teachers had been working for more than 10 years. At the time of the study, they were teaching elementary/middle school science grades (6^{th} through to 8^{th} grades). In general, males constitute about 2/3 of all mathematics teachers. Similar to the science teachers as regards years of teaching experience, most of them had 10 or more years of service experience. PSTs and their mentor teachers were selected by using simple random sampling because, in terms of academic achievements, the academic background and the schools assigned to pre-service teachers did not differ markedly.

Table 1. The distribution of Science and Mathematics mentor teachers according to genders and years of service

Science teachers		**Frequency (f)**	**Percentage (%)**
Gender	Women	35	43.21
	Men	46	56.79
Years of service	0-5	1	1.23
	6-10	15	18.52
	11-15	39	48.15
	15 and more	26	32.10
Mathematics teachers			
Gender	Women	30	36.14
	Men	53	63.86
Years of service	0-5	3	3.61
	6-10	24	28.92
	11-15	31	37.35
	15 and more	25	30.12

Data were purposefully collected in two main ways. Firstly, quantitative data responses concerning students' views were designed in the form of a questionnaire consisting of 45 items related to school settings, course contents, mentor teachers, and the field experience system overall. A research questionnaire called the Mentoring for Effective Primary Science Teaching (MEPST) instrument was developed and tested for reliability and validity by Hudson et al.

(2005). Cronbach alphas and validity tests indicated acceptable levels. Therefore, MEPST is accepted as a reliable data collection instrument. Secondly, following the questionnaires, selected students (N=12) in the Mathematics and Science education departments were interviewed by the researchers according to the research questions. Sample interview questions included how students evaluate the methods course and field experience course as well as their contents and implementation. Also, they were asked to input their suggestions, problems, and other issues such as school settings, mentor teachers' attitudes, classroom environments regarding the programs. We compared departmental similarities and differences. Also, the data were utilized to evaluate the field experience system currently applied in most universities and to offer some recommendations to achieve better field experience results.

Results

The findings of the study were analyzed according to quantitative data collected through participants` responses to the questionnaires and quantitative results according to their responses and feedback during the interview stage. Responses to the items on the student questionnaire are illustrated in Table 2 and Table 3. As Hudson et al.'s (2005) identified five factors based on five-factor analysis in their original paper of MEPST development; we have utilized five factors according to their final model. These five factors include personal attributes, system requirements, pedagogical knowledge, modeling, feedback.

In table 2, weighted average scores and standard deviations of those factors were illustrated for the group of science teachers. According to it, 'personal attributes' factor was found to be the highest percentage with 3.43 (out of 5). In other words, around 70% of the science teachers agreed upon the personal attributes such as confidence, attentiveness, and supportiveness during school experience and teaching process. On the other hand, 'system requirement factor' (aims, policy, and curriculum) has the lowest support (2.85/5.00 or 57%) from the students. Only half of them believed that their mentor teachers didn't emphasize enough on the education system and policy.

Table 2. Five factors distributions of pre-service science teachers' attitudes towards school experience and teaching courses

Factors	Item number	Average Scores ($\bar{X}$)	Standard Deviation (σ)
Personal Attributes	3,24,32,39,42,43	3.43	0.22
System Requirements	5,10,17	2.84	0.23
Pedagogical Knowledge	8,12,13,16,21,22,25,36,41,44	3.10	0.19
Modeling	11,14,15,18,28,31,33,34,35	3.28	0.15
Feedback	13,19,20,23,29,38,45	3.10	0.24
General average score		3.18	0.25

Note: Items corresponding to each factor relates to its position on the instrument are illustrated in Appendix A.

More detailed information of the findings of the questionnaire for pre-service science and mathematics teachers were tabulated according to the Likert scale, 1 (SD) meaning, "strongly disagree" to 5 (SA) meaning, "strongly agree" in Appendix A and B. Two columns constitute the science and mathematics students' responses, respectively, for each item. Appendix A demonstrates that prospective science teachers agree with items 34 (66%), 40 (68%) and 42 (63%) the most. These primarily involve statements regarding mentor teachers using science terminology, allowing teacher candidates' flexibility, and paying attention to what candidates have to say concerning practices. Maths teacher candidates (Appendix B), on the other hand, agreed with items 24 (71%), 39 (68%), and 27 (68%) the most. These items primarily focus on mentor teachers' interpersonal relations with maths teacher candidates, such as their being comfortable when talking to prospective teachers, as well as motivating and encouraging them in teaching maths lessons. These findings somewhat correlate with Hudson et al.'s (2005) results.

Pre-service science teachers mostly disagree with items 17, 26, and 29 with percentages of 55%, 52%, and 51% respectively. They claim mentor science teachers do not provide prospective teachers with any information on the state curriculum, help in their college homework, or provide feedback on teaching practices. Surprisingly, pre-service maths teachers also disapprove of the same items with percentages of 46%, 55%, and 55% respectively.

Table 3. Five factors distributions of pre-service maths teachers' attitudes towards school experience and teaching courses

Factors	**Item number**	**Average Scores ($\overline{x}$)**	**Standard Deviation (σ)**
Personal Attributes	3,24,32,39,42,43	3.62	0.14
System Requirements	5,10,17	3.09	0.34
Pedagogical Knowledge	8,12,13,16,21,22,25,36, 41,44	3.38	0.17
Modeling	11,14,15,18,28,31,33,34,35	3.31	0.22
Feedback	13,19,20,23,29,38,45	3.25	0.40
General average score		3.35	0.28

Note: Items corresponding to each factor relates to its position on the instrument is given in Appendix B.

Similarly, Table 3 summarizes five factor findings of pre-service maths teacher according to the responses on the student questionnaire. More detailed tabulated information is illustrated on Appendix A. Above table correlates to the table for pre-service science teachers in terms of the distributions of students' attitudes. Personal attributes were found to be the highest average percentage (3.62 out of 5.00 or 72%). Although average scores didn't range too much, only 62% of the pre-service maths teachers indicate that their mentor teachers discussed about educational systems and policies.

Moreover, according to the findings illustrated in Appendix B, the scores obtained on the students' attitudes towards the genders of mentor teachers, revealed that no significant correlation between mentor teachers' genders exists ($t = 1.366$ and $p = 0.184$) for both disciplines. On the other hand, only responses to items 20 and 41 show that male mentor teachers are more favored by the students with a p-value of 0.0278; this shows some correlation between science and maths students.

Table 4. Average students' attitudes and t-test scores in terms of mentor teachers' genders in practicum courses

Major		**N**	$\overline{X}$	**SS**	**Sd**	**t**	**p**
Science Education	Female	35	3.06	1.210	79	1.366	0.184
	Male	46	3.28	1.184			
Math Education	Female	30	3.46	0.73	81	0.89	0.375
	Male	53	3.30	0.77			

Based on the findings of interviews with prospective teachers, some quantitative results were collected and analyzed. The qualitative focus of the study contains prospective teachers' views and suggestions on three major sections related to the practicum course structure: mentor teacher general questions, mentor teachers and classroom, and suggestions for improvements. Two questions were answered by participating prospective teachers about mentor teachers' general demographic characteristics and what they think about mentor teachers with regard to the requirements of the course. Twelve of the prospective teachers (6 males and 6 females) who participated in the qualitative part of the study were randomly selected for the interview process. Five of the mentor teachers were females and two were males with teaching experiences between 12-29 years. At the time of the study they were all teaching in the metropolitan area of the city school district.

The majority of the interviewees positively (8 out of 12 or 67%) responded to the second set of questions regarding whether such practicum courses were necessary, useful, or beneficial. They supported these courses because they believe they are important, useful and crucial for implementing the methods and techniques taught in school, preparing themselves for their future roles as teachers, as well as contributing new unique experiences. For example, Student 11 stated:

> "I strongly believe that school experience and teaching practice courses are very helpful for us. With the help of these courses, I gained new experiences every time I went to the school, observing my mentor teachers' teaching methods and techniques; I have learned several new things I hadn't learned in other courses. When I am at school, I feel like the real teacher. I greatly appreciate the pro and cons of being a teacher by `learning by doing` in real classroom teaching environments"

On the other hand, it is very surprising that one third of the students thought that the courses were not beneficial. It is important to note their explanations. Two students complained about the exam schedules, as they need to take the KPSS exam, which is an aptitude test similar to PRAXIS II in the US, in the summer following their final year. Passing this test is necessary in order to become a teacher. They complained that they could not concentrate on the courses because of the stress due to the KPSS exam. The remaining two students said that these courses are necessary for classroom management issues. They did not comment on their usefulness or beneficial aspects.

Students' responses to the second set of questions on mentor teachers, their classroom environments, and how their lessons are shaped (teacher-centered or student-centered) were grouped into three general views: 1) satisfied with how he/she carried out his/her teaching by utilizing, in particular, modern views of instruction; 2) fairly satisfied due to limited use of modern approaches; and 3) not satisfied because of the use of traditional methods. Most of the students (9 out of 12) strongly agreed with the first opinion. They claimed that mentor teachers, in general, encouraged prospective teachers. Also, they utilized modern approaches of teaching such as group activities, collaborative learning, questioning, discovery learning, brainstorming, and classroom discussions. A student-centered approach was thus achieved. Student 2 said that:

> "Our mentor teacher mostly encouraged and appreciated us. Instead of negative and discouraging criticisms, he provided positive feedback to improve us. He communicates with his students and colleagues well. He can look at subjects from different perspectives. He utilized modern techniques such as hands-on experiments, questioning, and discovery learning in order for the students to discover their own learning style. I strongly believe that a student-centered approach was achieved."

In contrast, two of them said that their mentor teachers frequently used traditional educational techniques. In the second part of the question, the students identified some features mentor teachers should possess. Eight out of twelve students believed that mentor teachers should be a role model, a guide, someone who has respect for people in general, is sensitive, and who encourages and shows the student how to behave in unexpected situations. Three students suggested that the mentor teacher should use contemporary teaching methods, be approachable, communicative, and patient with students. In the last part of this question, students commented on the pros and cons of the lessons they observed and shared different ideas such as mentor teachers, use of active learning approaches, visuals, technology, lessons being boring at times, wasting time, classroom management issues, and long classes.

The last set of questions focused on possible improvements in the school experience and teaching practice methods courses in terms of how students' views of teaching were shaped during these field courses and finally their suggestions. Prospective teachers were asked to share their opinions about what they had gained from their school experiences. Many of them pointed out that they had seen an actual classroom and school settings, and how the theoretical side of instructional strategies might be applied. They also claimed that they found opportunities to transfer what they had learned in theoretical education courses. Another large group of prospective teachers said that they had extended their horizons and gained different perspectives.

On the other hand, they stated that they had not seen any useful applications of modern teaching techniques.

Students' main complaint was that the course was too short and that the living by learning side was its strongest feature. Some of them believed that the field course should continue in its current structure with increased hours spent at schools or that more field courses should be offered in teacher preparation programs. Other students complained about the structure, stating that field courses are offered in their senior year but that offering them before the senior year would make them better for prospective teachers. In addition, only one student should be sent to a school so that mentor teachers would be able to help the student more. Two students said that taking over mentor teachers' duties as a teacher allowed them to visualize how being a teacher. However, sometimes a teacher candidate student might expect more.

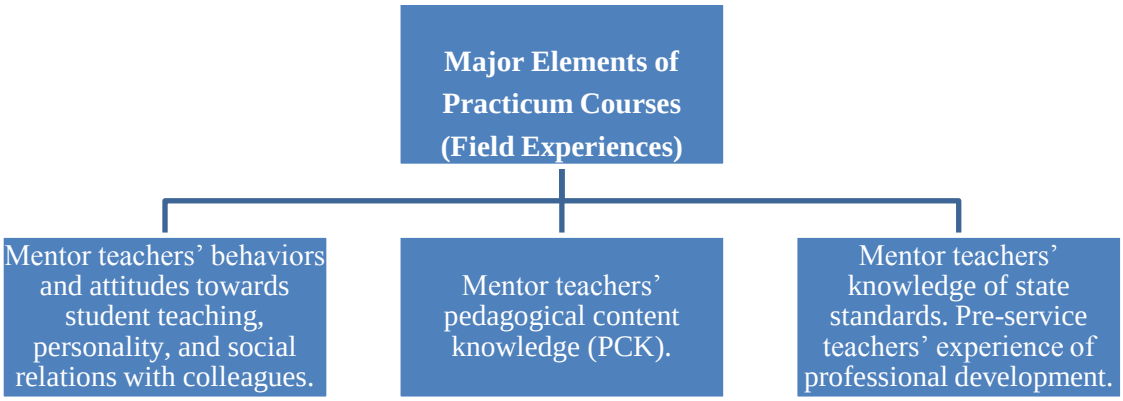
Discussion

This survey was conducted with the purpose of determining the expected roles of mentor teachers, practice schools, and associated faculty members via students` opinions regarding practicum courses such as field experience and teaching practices. For this purpose, a total of 164 pre-service teachers, 81 science and 83 mathematics education students, were enrolled in their last semesters in teacher preparation programs, and their mentor teachers and associated faculty members were selected to explore the research questions. At the end of the survey, the statistical results of the student questionnaire (Table 2) showed that pre-service science teachers have a positive view (59.3%, 56.8%, 66.6%, 60.5%, 67.9% and 63.0% agree and strongly agree about questionnaire items 24, 27, 37, 39, 40, respectively) in favor of mentor teachers who are flexible, supportive, and utilize terminology when it comes to classroom teaching.

According to Appendix B, although maths pre-service teachers believed that their mentor teachers are usually supportive (items 24, 38, 43) and personally kind people, in general, they did not evaluate them in terms of their teaching related activities and mentor teachers did not discuss subject curricula with mentees (items 6, 17, 42). For these reasons, it can be concluded that several students pay more attention to the mentor teachers' personality and social relations than to their teaching practices.

In contrast, both science and math pre-service teachers disapprove of the same items that focus on state standards, help in college homework, and feedback to class presentations. Mentor teachers not explaining the curriculum might mean that they do not possess enough information or that they are unable to construct interrelations among standards. Another reason might be the teachers' reluctance to transfer curriculum standards to prospective teachers. Interestingly, they did not provide enough feedback on students' class presentations. Similarly, the negative approaches of mentor teachers were previously found in other studies (Kalyoncu & Sazak, 2006). Therefore some mentor teachers' lack of knowledge or laziness affects the preparation of teacher candidates. Mentor teachers not paying sufficient attention to students' presentations may explain this.

Figure 1. Major factors in field experience courses



In the light of the outcomes of this study, it can be concluded that some changes may be necessary in order to better prepare future teachers (in science, maths and related fields) for actual teaching assignments. Also, the above-mentioned factors may play an important role.

First of all, mentor teachers for the student teaching practice placement should be carefully and deliberately selected to better suit the needs of pre-service teachers. Although research indicates that they are mostly friendly and easygoing, they sometimes do not agree with their school administration and mentor faculty members for a variety of reasons. As a result, teachers who strongly believe in the genuine importance of student teaching placements should be preferred.

In addition, we agree with recommendations in previous studies (e.g. Aksu & Demirtas, 2006) that teachers must be well-prepared in his/her own area of expertise and be aware of modern teaching strategies, activities, and most of all must possess a strong PCK structure. Teachers with at least five years of teaching experience are recommended. However, the college should offer professional development sessions for them prior to assigning them duties. They should be prepared beforehand for their duties, such as how to observe student teachers, how to provide feedback, how to evaluate them, and how to work with mentor faculty members. Some teachers do not have effective observation and evaluation skills. On the other hand, teachers with more than 15 years of experiences should not be allowed to become mentor teachers because they have no idea of modern teaching approaches or of professional developments.

The last factor to have a major impact on the process is related to mentor teachers' personality and their relations with colleagues, student teachers, and faculty members. Sometimes mentor teachers in our study never contacted mentor faculty members about his/her student teachers. More in-depth and statistical research studies should be conducted to develop more

beneficial practicum courses. In conclusion, a faculty member or a committee at the school of education should evaluate mentor teachers following the completion of field experience.

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Appendix A. Attitude scores' distribution of students participating in school experience / teaching courses directed at pre-service mathematics teachers

İt.#	**Taking school experience / teaching courses at school. Do you agree with these views?**	**SD**	**D**	**NS**	**A**	**SA**	$\overline{X}$
1	Displayed science content expertise	*7.4*	*11.1*	*21.0*	*54.3*	*6.2*	**3.57**
2	Showed me examples of how to program for science teaching	*7.4*	*29.6*	*8.6*	*42.0*	*12.3*	**3.29**
3	Assisted me to reflect on improving my science teaching practices	*8.6*	*21.0*	*25.9*	*37.0*	*7.4*	**3.53**
4	Increased my confidence to teach science	*9.9*	*14.8*	*18.5*	*42.0*	*14.8*	**3.63**
5	Discussed with me the aims of science teaching	*11.1*	*24.7*	*30.9*	*25.9*	*7.4*	**3.13**
6	Coped with the demands of the most recent science curriculum	*11.1*	*21.0*	*21.0*	*35.8*	*9.9*	**3.22**
7	Discussed my program for science teaching	*14.8*	*17.3*	*19.8*	*33.3*	*14.8*	**3.40**
8	Guided me with science lesson preparation	*9.9*	*24.7*	*24.7*	*28.4*	*12.3*	**3.43**
9	Encouraged me to teach science	*6.2*	*22.2*	*22.2*	*34.6*	*14.8*	**3.42**
10	Discussed with me the school policies used for science teaching	*9.9*	*30.9*	*21.0*	*25.9*	*12.3*	**3.40**
11	Modeled science teaching	*9.9*	*17.3*	*18.5*	*43.2*	*11.1*	**3.65**
12	Assisted me with classroom management strategies for science teaching	*7.4*	*17.3*	*23.5*	*33.3*	*18.5*	**3.55**
13	Gave me clear guidance for planning my science teaching	*12.3*	*27.2*	*19.8*	*29.6*	*11.1*	**3.06**
14	Assisted me with implementing science teaching strategies	*7.4*	*19.8*	*32.1*	*29.6*	*11.1*	**3.14**
15	Displayed enthusiasm for teaching science	*6.2*	*22.2*	*19.8*	*35.8*	*16.0*	**3.34**
16	Assisted me with timetabling my science teaching	*19.8*	*21.0*	*29.6*	*19.8*	*9.9*	**3.22**
17	Outlined state science/maths curriculum documents to me	*22.2*	*32.1*	*18.5*	*21.0*	*6.2*	**2.73**
18	Modeled effective class management when teaching science	*14.8*	*17.3*	*22.2*	*37.0*	*8.6*	**3.27**
19	Discussed evaluation of my science teaching	*13.6*	*16.0*	*18.5*	*37.0*	*14.8*	**3.27**
20	Observed me teach science	*9.9*	*22.2*	*13.6*	*34.6*	*19.8*	**3.81**
21	Developed my strategies to teach science	*8.6*	*27.2*	*23.5*	*27.2*	*13.6*	**3.36**
22	Discussed with me the knowledge I needed for teaching science	*16.0*	*19.8*	*22.2*	*30.9*	*11.1*	**3.67**
23	Provided oral feedback on my science teaching	*9.9*	*23.5*	*21.0*	*29.6*	*16.0*	**3.42**
24	Seemed comfortable in talking with me about science teaching	*3.7*	*12.3*	*24.7*	*30.9*	*28.4*	**3.84**
25	Discussed with me questioning skills for effective science teaching	*11.1*	*27.2*	*23.5*	*28.4*	*9.9*	**3.45**
26	Assisted me with university science assignments	*19.8*	*32.1*	*14.8*	*25.9*	*7.4*	**2.58**
27	Was approachable	*7.4*	*13.6*	*22.2*	*29.6*	*27.2*	**3.76**
28	Used hands-on materials to teach science	*11.1*	*19.8*	*24.7*	*29.6*	*14.8*	**2.87**
29	Provided written feedback on my science teaching	*21.0*	*29.6*	*21.0*	*17.3*	*11.1*	**2.59**
30	Addressed my science teaching anxieties	*14.8*	*22.2*	*32.1*	*23.5*	*7.4*	**3.11**
31	Was effective in teaching science	*4.9*	*19.8*	*19.8*	*46.9*	*8.6*	**3.37**
32	Instilled positive attitudes in me towards teaching science	*8.6*	*17.3*	*32.1*	*30.9*	*11.1*	**3.48**
33	Had a good rapport with middle school students doing science	*4.9*	*19.8*	*30.9*	*33.3*	*11.1*	**3.41**
34	Used science/maths language from the current primary science syllabus	*7.4*	*6.2*	*21.0*	*49.4*	*16.0*	**3.48**
35	Had well-designed science activities for the students	*4.9*	*19.8*	*32.1*	*32.1*	*11.1*	**3.27**
36	Provided strategies for me to solve my science teaching problems	*13.6*	*23.5*	*19.8*	*30.9*	*12.3*	**3.37**
37	Allowed me to teach science as often as I wanted	*4.9*	*14.8*	*13.6*	*37.0*	*29.6*	**3.39**
38	Reviewed my science lesson plans	*16.0*	*18.5*	*28.4*	*27.2*	*9.9*	**3.06**
39	Made me feel more confident as a science teacher	*6.2*	*13.6*	*19.8*	*37.0*	*23.5*	**3.71**
40	Allowed me flexibility in planning for teaching science	*9.9*	*6.2*	*16.0*	*43.2*	*24.7*	**3.73**
41	Gave me new viewpoints on teaching science	*6.2*	*17.3*	*25.9*	*35.8*	*14.8*	**3.31**
42	Listened to me when discussing science teaching practices	*4.9*	*18.5*	*13.6*	*42.0*	*21.0*	**3.60**
43	Was supportive in my teaching science	*4.9*	*21.0*	*16.0*	*42.0*	*16.0*	**3.53**
44	Showed me how to assess the students' learning of science	*7.4*	*25.9*	*22.2*	*27.2*	*17.3*	**3.41**
45	Clearly articulated what I needed to do to improve my teaching of science	*12.3*	*16.0*	*16.0*	*37.0*	*18.5*	**3.57**

Appendix B. Attitude scores' distribution of students participating in school experience / teaching courses directed at pre-service science teachers

It. #	**Taking school experience / teaching courses at school. Do you agree with these views?**	**SD**	**D**	**NS**	**A**	**SA**	$\overline{X}$
1	Displayed maths content expertise	**3.6**	**10.8**	**24.1**	**48.2**	**13.3**	**3.41**
2	Showed me examples of how to program for maths teaching	**8.4**	**19.3**	**21.7**	**36.1**	**14.5**	**3.22**
3	Assisted me to reflect on improving my maths teaching practices	**7.2**	**10.8**	**18.1**	**49.4**	**14.5**	**3.14**
4	Increased my confidence to teach maths	**3.6**	**12.0**	**21.7**	**43.4**	**19.3**	**3.37**
5	Discussed with me the aims of maths teaching	**13.3**	**21.7**	**16.9**	**34.9**	**13.3**	**2.94**
6	Coped with the demands of the most recent maths curriculum	**8.4**	**14.5**	**37.3**	**26.5**	**13.3**	**3.16**
7	Discussed my program for maths teaching	**3.6**	**19.3**	**24.1**	**39.8**	**13.3**	**3.16**
8	Guided me with maths lesson preparation	**7.2**	**13.3**	**21.7**	**44.6**	**13.3**	**3.09**
9	Encouraged me to teach maths	**7.2**	**15.7**	**20.5**	**41.0**	**15.7**	**3.30**
10	Discussed with me the school policies used for maths teaching	**4.8**	**21.7**	**16.9**	**42.2**	**14.5**	**3.00**
11	Modeled maths teaching	**7.2**	**10.8**	**16.9**	**39.8**	**25.3**	**3.28**
12	Assisted me with classroom management strategies for maths teaching	**7.2**	**14.5**	**15.7**	**41.0**	**21.7**	**3.38**
13	Gave me clear guidance for planning my maths teaching	**9.6**	**25.3**	**22.9**	**33.7**	**8.4**	**3.00**
14	Assisted me with implementing maths teaching strategies	**8.4**	**20.5**	**32.5**	**25.3**	**13.3**	**3.17**
15	Displayed enthusiasm for teaching maths	**10.8**	**13.3**	**22.9**	**37.3**	**15.7**	**3.33**
16	Assisted me with timetabling my maths teaching	**4.8**	**33.7**	**15.7**	**26.5**	**19.3**	**2.79**
17	Outlined state maths curriculum documents to me	**15.7**	**30.1**	**27.7**	**18.1**	**8.4**	**2.57**
18	Modeled effective class management when teaching maths	**4.8**	**25.3**	**25.3**	**27.7**	**16.9**	**3.07**
19	Discussed evaluation of my maths teaching	**4.8**	**24.1**	**22.9**	**36.1**	**12.0**	**3.23**
20	Observed me teach maths	**3.6**	**12.0**	**13.3**	**42.2**	**28.9**	**3.32**
21	Developed my strategies to teach maths	**4.8**	**15.7**	**32.5**	**32.5**	**14.5**	**3.10**
22	Discussed with me the knowledge I needed for teaching maths	**2.4**	**10.8**	**20.5**	**49.4**	**16.9**	**3.01**
23	Provided oral feedback on my maths teaching	**8.4**	**13.3**	**22.9**	**38.6**	**16.9**	**3.19**
24	Seemed comfortable in talking with me about maths teaching	**1.2**	**10.8**	**16.9**	**44.6**	**26.5**	**3.68**
25	Discussed with me questioning skills for effective maths teaching	**6.0**	**15.7**	**20.5**	**43.4**	**14.5**	**2.99**
26	Assisted me with university maths assignments	**30.1**	**25.3**	**14.5**	**16.9**	**13.3**	**2.69**
27	Was approachable	**7.2**	**9.6**	**15.7**	**34.9**	**32.5**	**3.56**
28	Used hands-on materials to teach maths	**18.1**	**24.1**	**22.9**	**22.9**	**12.0**	**3.17**
29	Provided written feedback on my maths teaching	**22.9**	**32.5**	**15.7**	**20.5**	**8.4**	**2.68**
30	Addressed my maths teaching anxieties	**10.8**	**27.7**	**18.1**	**26.5**	**16.9**	**2.86**
31	Was effective in teaching maths	**7.2**	**18.1**	**19.3**	**41.0**	**14.5**	**3.35**
32	Instilled positive attitudes in me towards teaching maths	**8.4**	**9.6**	**22.9**	**43.4**	**15.7**	**3.19**
33	Had a good rapport with middle school students doing maths	**6.0**	**16.9**	**25.3**	**33.7**	**18.1**	**3.26**
34	Used science/maths language from the current primary maths syllabus	**6.0**	**9.6**	**31.3**	**36.1**	**16.9**	**3.60**
35	Had well-designed maths activities for the students	**4.8**	**20.5**	**33.7**	**25.3**	**15.7**	**3.25**
36	Provided strategies for me to solve my maths teaching problems	**6.0**	**20.5**	**18.1**	**41.0**	**14.5**	**3.05**
37	Allowed me to teach maths as often as I wanted	**12.0**	**10.8**	**21.7**	**37.3**	**18.1**	**3.72**
38	Reviewed my maths lesson plans	**14.5**	**22.9**	**19.3**	**28.9**	**14.5**	**2.96**
39	Made me feel more confident as a maths teacher	**3.6**	**12.0**	**16.9**	**44.6**	**22.9**	**3.58**
40	Allowed me flexibility in planning for teaching maths	**3.6**	**10.8**	**16.9**	**39.8**	**27.7**	**3.67**
41	Gave me new viewpoints on teaching maths	**6.0**	**18.1**	**31.3**	**27.7**	**16.9**	**3.36**
42	Listened to me when discussing maths teaching practices	**3.6**	**14.5**	**21.7**	**38.6**	**21.7**	**3.56**
43	Was supportive in my teaching maths	**3.6**	**15.7**	**20.5**	**44.6**	**15.7**	**3.43**
44	Showed me how to assess the students' learning of maths	**7.2**	**20.5**	**20.5**	**27.7**	**24.1**	**3.21**
45	Clearly articulated what I needed to do to improve my teaching of maths	**2.4**	**18.1**	**21.7**	**36.1**	**21.7**	**3.33**