



Perspectives in regard to factors affecting the professional development of science teachers¹

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Abstract

As one of the crucial elements of education system, teachers' professional development is important to equip them with the education to compensate the needs of modern life. The major aim of this research is to determine the views of school principals and science teachers on the concept of professional development, and identify factors which affect science teachers' professional development. Both qualitative (semi-structured interview) and quantitative (survey) research methods were used in the research. The sample consisted of school principals and science teachers who were working in Nevşehir province and its districts. 6 school principals and 6 science teachers were interviewed in-depthly. In addition, data from 109 science teachers were also collected through questionnaires. The data obtained through interviews were analyzed by descriptive analysis. Simple correlation technique and percentage distributions were used to analyze the questionnaires. The research findings show that in general, the teaching profession is being perceived as a profession which starts with pre-service training and continues with in-service training; therefore, it is an ongoing process. It has also been discovered that in this process, "personal and external factors" affect science teachers' professional development. Thus, teachers' professional development should be supported in line with these factors.

Keywords: Science Teachers; Professional Development; Teacher Education.

1. Introduction

Today, we are faced with the reality that it is inevitable to change for development. One of the consequences of this fact is that it becomes difficult for teachers to implement innovative programs in their courses (Huang Bao, 2006). To overcome this problem, teachers must take an active role in their learning (Van Eekelen, Vermunt & Boshuizen, 2006) and take responsibility to overcome the difficulties they encounter in this process. Despite all the changes, teachers as key people, have an important role in education (Güler, 1992), because there is a direct relationship between the quality of education and teaching, and the quality of teachers (Akalın, 2014). In other words, it is regarded that people improve their life through education (Çermik & Turan, 1997, Alkan, 2001), and it is an important task for teachers to shape the society and create the future (Uzun et al., 2013). A good education system will be possible through teachers who are well-trained and continue with their self-development (Kaçan, 2004). Therefore, the most important element of an education system is teachers (Çermik & Turan, 1997, Gültekin, 2002; Kavcar, 2002; Özdemir, 2004; Yetim & Göktaş, 2004; Tekin & Ayas, 2006; Sönmez, 2008).

In order to reach success in education system, one should aim to be "a good teacher" not just be "a teacher" (Meriç, 2004). Thus, as latent power of the educational process, teachers have

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important responsibilities. One of these responsibilities is to ensure their professional development. Professional development is essential for teachers to be more effective in their classrooms, to make their learning more regular and systematic instead of being incidental in the profession, to update the skills and the information given in the educational institutions and to increase the productivity of the employees in those institutions (Seferoğlu, 2009). In particular, it is expected from teachers to evaluate their competencies, practices and approaches, and benefit from the opportunities of continuous development (Türk Eğitim Derneği, 2009). In general, professional development aims to improve people's self-development, their organizations' development and the services offered by them (Yetim & Göktepe, 2004; Akçamete, 2005). In order the results of professional development to be more efficient and effective, the concepts of change and development have to come to the fore. Adapting to the changes and developments is possible through lifelong learning (Yalın, 2001). Briefly, teachers' conceptions of professional development should be in line with the needs of individuals they interact and should enhance the development of the individuals.

In literature, there are studies on the views with regard to teaching profession and the development of teaching profession (Brighouse, 1995; Helsby, 1995; Çelikten et al., 2005; Gödek, 2006; Erdemir, 2007; Türk Eğitim Derneği, 2009), and the factors affecting the development of teaching profession. For example, Uzun et al., (2013) determined that most of the science teachers did not perceive themselves as *professional teachers* and believed that professionalism may occur over time. In addition, a significant portion of teachers reported that deficiencies in in-service training opportunities are disadvantages towards *becoming a professional teacher*. Azar & Çepni (1999) found that the number of activities and time spent on each activity has direct proportion with the experience. Aydın (2008) investigated teachers' perspectives on in-service training programs, the support given by school principals and how they reflect this support to education. They found that there was a significant difference between their personal characteristics and their use of knowledge and skills in their schools. Baran (2008), determined that distant in-service teacher training increases the quality of education and in-service training allows teachers' professional development. Çatmatlı (2006) found a relationship between teachers' views and the laboratory conditions of their schools. Furthermore, in-service teacher training courses were found to be appropriate in terms of ICT teachers' competencies, teaching methods and teaching tools, and ICT teachers seemed to believe that they could apply their learning into their own classes. He also identified some problems concerning in-service teacher training courses including the lack of training needs analysis, the delivery time of the courses and complexity of books. In Gönen's & Kocakaya's (2005) study, even though the majority of physics teachers found in-service training necessary, the number and quality of in-service training they received were below their expectations. In his research to enhance physics teachers' professional development, Kaya et al., (2005) found that in-service training program developed by the university was successful in the development of teachers' professional knowledge, skills and attitude on laboratory.

As a result of the literature review, in Turkey, it is seen that there are various studies on teaching profession, but there is not sufficient study on the professional development of science teachers. Therefore, the main aim of this research is to determine the views on the concept of professional development, and the factors affecting teachers' professional development from the perspectives of school principals and science teachers. The sub-questions that guided this research are:

1. What are the views of science teachers and school principals on the concept of professional development?
2. What are the factors that contribute to the professional development of teachers?

2. Methodology

In researches related to this topic, generally descriptive survey model (Şişman & Acat, 2003; Gödek, 2006; MEB, 2006; Çiftçi, 2008; Büyük et al., 2010) and case study approach were used (Tekin & Ayas, 2006; Erdemir, 2007). In this study, descriptive survey model was used. Descriptive

research aims to describe the views and characteristics of large masses (Büyüköztürk et al., 2008). It presents the “meaning” of events, objects, entities, institutions, groups and various fields, takes into account the relationship between the present case and previous events and circumstances, aims to explain the interaction between the cases (Kaptan, 1983: 63). Büyüköztürk et al., (2008), suggested that in some studies, a combination of qualitative and quantitative research methods may be used concurrently or sequentially. In related literature, there are studies that combine qualitative and quantitative research methods (Gödek, 2002; Tekin & Ayas, 2006; Çiftçi, 2008). In this study, both qualitative (interviews) and quantitative (survey) research methods were used together. The interviews allowed the researchers to examine school principals’ and teachers’ views in depth while the survey method gave the opportunity to reach large numbers of teachers’ views concerning professional development.

a- Sampling

The research was carried out in schools affiliated with Turkish Ministry of National Education in Nevşehir province and its districts. In determining the sample in the study, random sampling method was used in order to avoid loss of time, money and labor (Büyüköztürk et al., 2008). In the interviews, the sample consisted of six science teachers and six school principals who work at 11 schools in Nevşehir. On the other hand, 109 science teachers also voluntarily participated in the study by filling out questionnaires.

b- Data collection

In related studies (Can, 1987; MEB, 1997; Yalın, 2001; Güzel, 2002; Şişman & Acat, 2003; Meriç & Tezcan, 2005; MEB, 2006; Türk Eğitim Derneği, 2009; Büyük et al., 2010) it was observed that the general questionnaire method was used in collection of data. Some studies (Tekin & Ayas, 2006; Çiftçi, 2008) were carried out by using both interviews and questionnaires. In addition, Tekin & Ayas (2006) used the observation form in their study while Erdemir (2007) used both observation forms and interviews in data collection. In this study, both semi-structured interviews and Likert-type questionnaires were used.

c- Semi-structured interviews

In this study, in order to “*to learn more deeply*” (Kuş, 2009: 87), about school principals’ and science teachers’ views concerning professional development and factors affecting professional development, semi-structured interviews were used. With this purpose, a semi-structured interview form consisting of eight open-ended questions was prepared. To ensure the content validity of the questions, two field educators, in the Department of Science at a state university, were consulted. One of them was a specialist in assessment and evaluation in education, the other was a specialist in teachers’ professional development. In interviews, we tried to establish a safe environment. Participants were informed that their identity would be kept confidential. Interviews were carried out at seven primary schools, which took about 25-30 minutes. Their permission was received prior to the recording of the interviews.

d- Questionnaire

The survey technique gave the researchers an opportunity to reach a large sample on their views concerning professional development and factors affecting science teachers’ professional development, and to obtain “*a wide variety of data*” (Çepni, 2007: 169). From the literature review and the findings of the interviews, 64 sentences which reflect teachers’ views concerning the factors affecting science teachers’ professional development have been identified. Following this, the sentences have been translated into a five-point Likert-type questionnaire. Two faculty members were consulted on the structure and content validity of the survey.

In accordance with their views, 35 of the items were selected. For the reliability testing of the survey, a pilot study was conducted with 43 teachers. Factor analysis was applied to the data obtained from the pilot study.

The data obtained from the pilot study has been put through factor analysis. Items with sufficient item loading have been retained in the survey while items that produced loadings of 0.30 or below have been removed from the survey (Appendix 1). Factor analysis has been carried out on the items whose factor loading values have been assessed. The survey, which has been obtained with this method, contains 27 items with 3 sub-dimensions.

In the study, the naming of the factors has been done by taking into consideration the variables with greatest factor loading. All factor structures have been examined and the data obtained from this examination has been assessed in terms of structure validity.

The first factor has been named as “*factors contributing to professional development*” considering the majority of the variables it includes. The item loadings of the 13 items included in this factor (4, 5, 6, 7, 8, 9, 10, 11, 20, 21, 31, 34, 35) vary between 0.82-0.31. The second factor, considering the majority of the variables included in it, has been named “*views on professional development*”. The total of the 7 items that fall under this factor (1, 14, 18, 23, 25, 26, 32) have item loadings varying between 0.81-0.36. The third factor has likewise been named, with consideration to the majority of the items included in it, as “*views on in-service training*”. The total of the 7 items included under this factor (3, 12, 13, 15, 16, 27, 29) have item loadings that vary between 0.71-0.37.

The variance of Factor 1 has been computed as 18 %, the variance of Factor 2 as 12.6 % and the variance of Factor 3 as 11.7 %. The total of the scale explains 42.3 % of the total variance. According to Gorsuch (1974), the higher proportion of variance rendered by a factor analysis, the stronger the factor structure of the scale; while accordingly to Scherer et al., (1988) variance proportions between 40 % and 60 % are considered sufficient for the social field (quoted in Tavşanlı & Keser, 2001).

As a result of the total factors analysis of the survey, which has been given its final form as explained, the Cronbach’s Alpha internal consistency coefficient has been computed as 0.79. The Cronbach’s Alpha internal consistency coefficient for Factor 1 has been computed as 0.80, for Factor 2 as 0.77 and for Factor 3 as 0.71. The analysis of the totality of the factors has rendered the Cronbach’s Alpha internal consistency coefficient of 0.79. Çepni (2007) states that the computed consistency coefficients take on a value between 0 and 1 and this value tends to be higher the more it is free of random error.

In order to increase the reliability of the research, the researcher himself notified the participants of the purpose of this research and made some explanations about the questionnaire before conducting the questionnaires. Then, the questionnaires were distributed and data were collected.

e- Data analysis

Qualitative data analysis methods were used in the analysis of the interviews and quantitative analysis methods were used in the analysis of the questionnaires.

At the end of the qualitative research, large amounts of data were subject to detailed analysis. The obtained data is gathered under the main theme, organized into groups, and is defined (Özenç Uçak, 2000). The data obtained through interviews were analyzed through the content analysis. During the coding of the data set, a final theme was crystallized out of the draft theme. In the interviews, the responses given to each of the questions were analyzed into groups according to their similarities and differences. The opinions are shown as frequency (f) and percentages (%) in the corresponding tables.

In the quantitative data analysis, factor analysis and reliability testing were carried out. Then, simple correlation techniques and the percentage distribution were used (Kaya, 2011).

3. Findings

a- Findings on 'Professional Development'

In the interviews and questionnaires, some questions were asked to determine the participants' views regarding the concept of 'professional development'. In this study, the abbreviations (Y) for school principals and (Ö) for science teachers will be used.

The participants were asked "For you, what is professionalism?" 67 % of the participants gave similar answers as "being successful in one's job" (Table 1). For example:

"Being a specialist; is to do one's job well, seriously and successfully". (Y3)

For some school principles and science teachers, professionalism is "to develop themselves". For example:

"It is teachers' self-development". (Y1)

"A person should follow changes and developments in the business". (Ö4)

One of the teachers stated his view as "doing one's job successfully" and "develop themselves" in the following way:

"Professionalism is to master one's business and also to keep track of changes in the field." (Ö2)

Table 1. Views on the concept of 'Professionalism' (interview results)

Topic	Views	School principals		Teachers	
		f	%	f	%
Professionalism	<i>Being successful in one's job</i>	4	67	4	67
	<i>Develop themselves</i>	1	17	2	33
	<i>It is a career stage</i>	1	17	-	-
	<i>Obtaining gains from own job</i>	-	-	1	17

In the interviews, participants were asked "What are you doing for your professional development?" 83 % of school principals expressed similar views as follows "follow the changes in regulations and in the curriculum" (Table 2.):

"Firstly, for our development, we have to follow the current issues in our profession." (Y2)

"We are trying to adapt ourselves to the changing conditions." (Y1)

Half of the teachers stated similar views as follows "From the Internet, I follow the developments related to my field". This view was stated as:

"I'm trying to follow scientific developments through the Internet". (Ö3, Ö5)

Table 2. Views on 'professional development' (interview results)

Topic	Views	School principals		Teachers	
		f	%	f	%
Things done for Professional development	<i>I follow the changes in regulations and in the curriculum</i>	5	83	1	17
	<i>I follow the developments related to my field</i>	-	-	3	50
	<i>I am not doing anything</i>	-	-	2	33

When the participants were asked "Do you think that teaching is a profession? Why?" 83 % of the participants believed that "Teaching is a profession" (Table 3.). However, unlike others, a school principal believed that "teaching is both a profession and an amateur profession" and stated his view as follows:

"Of course, teaching is a profession but amateurism also should not be forgotten. During the lectures, teachers should also preserve amateurism" (Y1)

Table 3. Views on teaching profession (interview results)

Topic	Views	School principals		Teachers	
		f	%	f	%
Teaching profession	<i>Teaching is a profession</i>	5	83	5	83
	<i>Teaching is both a profession and an amateur profession</i>	1	17	-	-

On the other hand, in the questionnaires, teachers' views regarding "professional development" have also been obtained. The responses are shown in Table 4.

Table 4. Views on "professional development" (questionnaire results)

	strongly agree	agree	undecided	disagree	strongly disagree
<i>Teaching is a profession</i>	77,1	22,0	-	-	0,9
<i>The individual must be willing for professional development</i>	89,9	9,2	0,9	-	-
<i>Qualified teacher trainees must develop themselves in the profession</i>	73,4	26,6	-	-	-
<i>Professional development is a process</i>	61,5	38,5	-	-	-
<i>For professional development, change is indispensable</i>	60,6	36,7	1,8	0,9	-
<i>I believe that the communication within the school contributes to the professional development.</i>	35,8	56,0	6,4	1,8	-
<i>I exchange information with my colleagues at school</i>	33,0	62,4	3,7	0,9	-
<i>My professional development will contribute to the professional development of my colleagues</i>	30,3	58,7	8,3	1,8	0,9
<i>At least 5-6 years of experience in the profession is necessary for the implementation of professional development</i>	5,5	21,1	7,3	45,9	20,2
<i>Quality education is sufficient for professional development of teacher candidates</i>	6,4	33,0	22,9	26,6	11,0
<i>Professional development is only needed in the first years of teaching</i>	52,3	42,2	1,8	0,9	2,8

As shown in Table 4, 99,1% of teachers indicate that teaching is a profession and the individual must be willing for professional development. The majority of teachers (97,3%) believed that change is indispensable for professional development; in other words, for professional development, teachers should be open to change. Again, the majority of teachers (95,4%) reported that they exchange information with their colleagues at school, while 91,8% thought that the communication within the school influence their professional development. 89% believe that their professional development will contribute to the professional development of their colleagues. While 37,6% of teachers believe that quality education is sufficient, and 39,4% believe that it is not sufficient for professional development of teacher candidates. Even though, all teachers defend the opinion that teaching profession is a process and a qualified teacher

trainee must develop himself during his profession, the majority of (94,5%) teachers pointed out that professional development is only needed in the first years of teaching.

As a result of these findings, it can be stated that teaching is a profession and professional development is a process. Self-development throughout the career of teachers who have received a quality education, are open to change, and exchange information with colleagues at school, are prerequisites for professional development.

b- Findings regarding factors affecting professional development

In the interviews, school principals and teachers, whereby in the questionnaires, teachers were asked questions concerning the factors affecting professional development.

When school principals and teachers were asked "Do you think that the communication within the school contributes to the professional development? And why?" all school principals and half of the teachers seemed to agree with this view (Table 5.) and stated their opinions as follows:

"Through interactions among ourselves, we contribute much more things to our professional development." (Y1)

"Since each teacher in the same institution has a different knowledge base, we are brainstorming with them." (Y5)

"I give importance to communication with school principal, colleagues and also with students." (Ö4)

Rest of the teachers defended the opinion that "communication within the school does not contribute to the professional development":

"...personally, I positively contribute to my own professional development". (Ö2)

Table 5. Views regarding the communication within school (interview results)

Topic	Views	School principals		Teachers	
		f	%	f	%
The contribution of communication within school to professional development	<i>contributes to my professional development</i>	6	100	3	50
	<i>does not contribute to my professional development</i>	-	-	3	50

When the participants were asked "Is there any impact of scientific publications on the professional development of teachers? Why?" 83% of teachers and all school principals believed that "scientific publications positively impact teachers' professional development". Their views were expressed as follows (Table 6):

"Absolutely affects, because the information in the textbooks are not updated continuously. In this way, I would have the opportunity to update my knowledge."(Ö4)

"Especially, the publications on science, technology and also on nature are contributing to my professional development. For example, concerning the nature; perhaps I can have information about solutions to the environmental problems in places I can never see in my life." (Y2)

Table 6. Views on the contribution of scientific publications to the professional development of teachers (interview results)

Topic	Views	School principals		Teachers	
		f	%	f	%
The contribution of scientific publications to the professional development	<i>Yes, scientific publications contributes to the professional development of teachers</i>	6	100	5	83
	<i>Undecided</i>	-	-	1	17

The participants were asked that "What are the problems that affect the professional development of science teachers?" 67% of school principals and teachers pointed out the problem of "inadequate laboratory conditions and resources" in their answers (Table 7). They stated their opinion as follows:

"... in primary schools, the deficiencies in teaching materials hinders professional development". (Y6)
"The lack of necessary materials in the laboratory". (Ö4)

In addition, 33% of school principals and 17% of teachers mentioned deficiencies "in teachers' own subject area" as follows:

"The lack of knowledge concerning using the laboratory". (Ö1)
"If our teacher does not or is unable to follow developments in his/her subject area". (Y6)

Table 7. The problems which affect science teachers' professional development (interview results)

Topic	Views	School principals		Teachers	
		f	%	F	%
The problems which affect science teachers' professional development	<i>Inadequacies in the laboratory conditions and resources</i>	4	67	4	67
	<i>Lack of knowledge in own subject area</i>	2	33	1	17
	<i>Deficiencies in the infrastructure of school buildings</i>	1	17	3	50
	<i>Not to follow up/ keep up with scientific publications</i>	1	17	-	-
	<i>Inadequacies in course hours</i>	-	-	1	17
	<i>Work overload</i>	-	-	1	17

When the question "How can a good science teacher development be achieved? And why?" were asked, half of the school principals and 33% of teachers believed that "qualified teachers should be trained" (Table 8). Their views are as follows:

"I think, first of all, science teachers should develop themselves at the universities." (Y6)
"Firstly, training should be provided at the university. During bachelor's degree, experiments should be given greater importance". (Ö4)

Some of the participants have embraced both ideas of "following scientific publications" and "eliminating laboratory deficiencies". For example:

"For continuous self-development of his career, teachers should follow publications related to their field." (Y6)
"Learning and teaching of how to use the laboratory instruments are extremely important. Therefore, these deficiencies must be overcome". (Ö1)

Table 8. Views on the development of science teachers (interview results)

Topic	Views	School principals		Teachers	
		f	%	f	%
How science teachers' professional development can be achieved?	<i>Qualified teachers should be trained</i>	3	50	2	33
	<i>Scientific publications should be followed</i>	2	33	1	17
	<i>Laboratory deficiencies must be eliminated</i>	2	33	2	33
	<i>Professionalism should be adopted</i>	1	17	-	-
	<i>People who choose teaching profession should perform their profession passionately</i>	1	17	1	17
	<i>Information concerning educational activities carried out in different cultures and regions must be obtained</i>	1	17	-	-
	<i>Developments should be followed</i>	-	-	2	33

As a result, the factors including giving importance to communication within the school, following scientific publications, training of qualified teachers, eliminating laboratory deficiencies, adopting professionalism, performing the profession with commitment, acquisition of information about training activities carried out in different cultures and regions, following the developments were pointed out by the participants as factors affecting science teachers' professional development.

Participants have also identified some problems that prevent professional development. These problems are inadequacies in laboratory conditions and resources, teachers' lack of subject matter knowledge, deficiencies in the infrastructure of school buildings, failure to follow scientific sources. On the other hand, in the questionnaires, teachers' views concerning the factors that contribute to their professional development have been determined (Table 9).

Table 9. The factors that contribute to the professional development (Questionnaire results)

	strongly agree	agree	undecided	disagree	Strongly disagree
<i>In professional development, I am open to change</i>	50,5	47,7	1,8	-	-
<i>As a teacher, I develop myself continuously</i>	26,6	62,4	10,1	0,9	-
<i>I do not avoid expenditures required for my professional development</i>	40,4	44,0	12,8	1,8	0,9
<i>Following scientific developments affects professional development in a positive way</i>	83,5	15,6	-	0,9	-
<i>Scientific publications that are published at a level that teachers can easily understand will contribute to teachers' professional development</i>	40,4	56,9	1,8	0,9	-
<i>Doing the job you like has positive influence on professional development</i>	89,9	10,1	-	-	-
<i>Low competency in laboratory use of a teachers, negatively affects professional development</i>	38,5	49,5	8,3	2,8	0,9
<i>Teachers' success in professional development should be rewarded</i>	67,0	30,3	1,8	0,9	-

98,2 % of teachers believed that they are open to change, 89% reported that they develop themselves continuously, and 84,4 % do not avoid expenditures required for their professional development. For 99,1%, following scientific developments and for 97,3% the simplicity of the scientific publications at a level that teachers can easily understand would contribute to teachers' professional development. All teachers indicated that doing the job you enjoy would have a positive influence on teachers' professional development while, 88% thought that low competency in laboratory use of a teacher, would negatively affect professional development. Furthermore, 97,3% of teachers reported that awarding success would contribute to their professional development.

Consequently, teachers indicated that, the factors including doing the job that you like, being open to change, developing themselves continuously, not avoiding expenditures required for professional development, supporting teachers through scientific publications at a level that they can easily understand, developing teachers' laboratory skills, awarding success would contribute to science teachers' professional development.

4. Discussion

a- Views on Professional Development

As a result of the interviews, participants seemed to be aware of the concept of professionalism. When defining professionalism, *doing the profession best* and *being successful in the profession* were stated as common opinions. Furthermore, from the results of interviews and questionnaires, it can be inferred that teaching is perceived as a *profession* by school principals and science teachers studied. In the research conducted by Turkish Education Association on teacher competencies (2009), it was discovered that perceptions like “teaching profession traditionally considered as a holy profession”, and a special value and respect attributed to teachers due to their profession, are gradually decreasing in the society. This situation shows that a negative perception is growing concerning the social status of teaching profession among some of the school principals and teachers. Despite this negative perception expressed by the participants on the social status of profession, it was determined in this research according to interview and questionnaire results that the school principals and teachers seemed to have a positive perception concerning the profession; they value the profession and adopt it.

In the questionnaires, teachers seemed to perceive the professional development as a process and stated the belief that change is essential for professional development and for change the individual should be willing. Development of teachers' personalities, as well as their professional qualifications and constantly renewing themselves are necessary to be an effective teacher (Çelikten, et al., 2005). In the interviews, teachers stated that the use of the Internet which is part of everyday life is important for professional development. According to these views, it might be extrapolated that professional development is a process and change for professional development and the willingness for change are essential. In this process, the most important element supporting teachers' change is the use of the Internet. Therefore, Internet or computer-based support for teachers might be considered as a practical solution for their professional development.

The majority of the teachers in the questionnaires stated that professional development is only necessary in the early years of the teaching profession while approximately 40% believed that quality education would be enough for the professional development. This result may be due to teachers' lack of experience in their first years of the profession and their thought concerning inadequacies in their pre-service training. As Gödek (2002) points out, at the beginning of their careers, the development of knowledge base, especially the development of subject matter knowledge for beginning teachers seem as a problem. Therefore, as Erdemir (2007) argues, beginning teachers should obtain some help from experienced teachers and administrators when they need.

b- Factors contributing to professional development

In the interviews, all school principals and half of the teachers believed that communication within the school affects their professional development. However, the belief expressed by half of the teachers is that *communication within the school does not contribute to teachers' professional development* might be interpreted as a lack of communication with colleagues at the school where they work. However, for Çiftçi (2008), the problems in communication between teachers complicate the functioning of the institutions in primary schools. Therefore, teachers' communication with colleagues should be improved for the functioning of the institutions and to ensure the professional development of teachers. In order to assist teachers' professional development, cooperation among teachers needs to be facilitated (Park et al., 2007). In this way, "school-based professional development" (Brighouse, 1995) could be supported.

In the interviews, participants also mentioned about the contribution of scientific publications to their professionalism. Similarly, in the questionnaires, teachers seemed to believe that following scientific developments would positively affect their professionalism, particularly simplicity of scientific publications at a level that teachers could easily understand would contribute to their professional development. According to the findings obtained by the Ministry of Education, Department of Educational Research and Development (EARGED), when planning for their annual programs, teachers' inability to access the latest training program developed in their own subject areas and not benefiting from adequate sources led to failures in the implementation of the program (MEB, 1997). In line with this finding, another study, EARGED found that school principals and teachers could "partially" access and benefit from professional publications (MEB, 2006).

In general, in the interviews, deficiencies in laboratory conditions and resources, and inadequacy in the infrastructure of school buildings were identified as problems affecting science teachers' professional development. The main reason for these problems could be considered as financial difficulties; however, a study carried out by EARGED reached the conclusion that the usability of laboratory resources was greater than 80% at schools (MEB, 1995).

In the interviews, the participants defended the notion that for professional development, qualified teachers should be trained at the Faculties of Education while some teachers have expressed the view that their development and progress should constantly be monitored. Therefore, teaching profession seemed to be perceived as an ongoing process which starts with pre-service training and continues through in-service training. Overcoming deficiencies affecting this process will ensure a more qualified development of the profession. Accordingly, Saban (2000) notes that the processes of pre-service training and in-service training should be integrated to ensure professionalism in teaching profession.

Teachers filling the questionnaires seemed to believe that doing a job you enjoy would positively influence their professional development and it is essential to be open to change for professional development. For Beycioğlu & Aslan (2009), teachers should prepare themselves for change or to be at peace with the facts of change. Özmen & Sönmez (2007) also suggest that teachers must be trained as individuals who are continuously open to innovations, participative and can work in partnership.

The improvement of teachers' laboratory skills will contribute to their professional development. In a study conducted by Büyük et al., (2010), it was determined that as science teachers did not recognize and use laboratory resources sufficiently, they did not have knowledge about maintenance and repair of the laboratory tools, could not use teaching methods and techniques in their laboratory courses. Güzel (2002) pointed out that science teachers need special training for the use of laboratories. This reveals that teacher professionalism is a complex situation in terms of continuity (Helsby, 1995).

This research also revealed that rewarding the achievements of teachers has been identified by the participants as one of the factors contributing to the professional development. Balcı (1989) also defended that evaluating people who can teach or cannot teach and people who work or do

not work and awarding teachers could make the teaching profession more attractive. Balcı (1991) also pointed out that awarding the teachers would increase the status of teaching. Gül (2007) also suggests that school principals should use reward system as a supportive instrument for teachers' professional development.

5. Conclusion

According to the results gathered in the study, it might be said that school principals and science teachers seem to be aware of the concept of *professionalism*. In line with their views, the concept of professionalism could be defined as “*doing one's job in the best way and being successful in the profession*”. Teaching was expressed as a *profession*. Professional development in teaching has been stated as *an ongoing process which starts with pre-service education and continues through in-service education and change is essential in this process*. This view is in line with Fullan's (1991) since he describes professional development as a period that starts with the basic training of teachers and continues during their teaching career. Therefore, professional development cannot be separated from school development and teachers' development.

As a result of the interviews and questions, the factors affecting the development of teaching profession could be summarized into two groups as “*individual and external factors*”.

a. Individual factors

- being open to change,
- placing emphasis on professional development from the beginning of the career,
- adopting the profession,
- doing one's job in commitment,
- being willing for self-development,
- trying to overcome own deficiencies (subject matter knowledge and laboratory skills),
- attaching importance to communication and information exchange with colleagues,
- following scientific publications,
- not avoiding expenditures required for professional development.

b. External factors

- training of qualified teachers in the faculties of education,
- overcoming deficiencies in infrastructure (overcoming deficiencies in school buildings and laboratory conditions, the development of laboratory resources),
- organizing course plans in a manner that allows for professional development,
- publishing scientific publications at a level that could be understood by teachers,
- rewarding success in teachers' professional development.

Taking steps to support and meet the requirements of teachers' professional development is important. External factors affecting teachers' professional development, in other words the support by the institutions and the government, are essential to contribute to teachers' individual efforts.

6. Suggestions

The most important result mainly identified in this research is that both individual and external factors affect professional development of science teachers. Primarily, in order to make a realistic contribution to the professional development of science teachers, quality teachers should be trained in a way that they could take on the responsibility of their self-improvement, and adopting lifelong learning as a basic habit. Teachers should be qualified as being open to change, adopting professionalism starting from the first year of the profession and placing importance on professional development. Similarly, Fullan (2001: 253) states that “*Professional development is not about*

workshops and courses; rather, it is at its heart the development of habits of learning that are far more likely to be powerful if they present themselves day after day”.

As Guskey (1999) also argues, simply spending time for the professional development does not guarantee the effectiveness of teachers. The quality of time devoted to the professional change is more important than the quantity of time devoted to professional development. Therefore, in-depth changes and improvements should be made in school cultures and in educators' perspectives on professional development. Teachers' individual efforts to improve themselves should be supported by the institutions they are working at and by the Ministry of Education. Scientific publications should be published in a way that teachers could easily understand. Their demonstrable success should be awarded to contribute to their professional development.

For science teachers' professional development, pre-service training and in-service training should be integrated to complement each other and to provide integrity in the process.

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Appendix 1. Factor analysis of the survey on science teachers' views on professional development and on the factors affecting professional development
(reverse principal components analysis)

Item number	Common factor variance	Factor-1 item loading	Loading after reversal		
			Factor-1 item loading	Factor-2 item loading	Factor-3 item loading
1	,14	,23	,05	,36	-,01
2	,22	-,13	-,37	,29	,02
3	,39	,22	-,08	,37	,48
4	,67	,73	,82	,08	,03
5	,59	,64	,76	,02	-,08
6	,22	,20	,33	-,06	-,33
7	,17	,34	,31	,20	-,16
8	,55	,69	,66	,17	,29
9	,53	,71	,59	,32	,27
10	,44	,58	,64	,13	-,13
11	,30	,46	,47	,20	-,20
12	,16	,10	-,04	,15	,37
13	,35	-,02	,05	-,29	,52
14	,29	,49	,28	,44	,14
15	,52	,14	,13	-,14	,70
16	,58	,32	,07	,29	,70
17	,27	,42	,31	,16	,38
18	,63	,74	,47	,60	,22
19	,23	,18	,27	-,22	,34
20	,31	,37	,50	-,14	,19
21	,37	,56	,55	,24	-,12
22	,32	,54	,38	,42	,04
23	,44	,59	,34	,55	,14
24	,04	-,07	-,01	-,17	,13
25	,68	,52	,09	,81	,15
26	,51	,33	-,02	,71	-,13
27	,51	,03	-,13	,056	,70
28	,42	,59	,47	,43	-,11
29	,52	,11	,06	-,11	,71
30	,34	,05	,21	-,37	,40
31	,23	,17	,35	-,29	,16
32	,40	,43	,13	,62	-,02
33	,30	,54	,39	,37	,10
34	,56	,66	,74	,07	,03
35	,37	,56	,53	,26	-,13

explained variance:

Total : 42.3 %

Factor 1: 18.0 %

Factor 2: 12.6 %

Factor 3: 11.7 %