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**Personal Professional Development
Efforts of Science and Technology
Teachers in their Fields**

Ayşegül Bilgin¹, Mustafa Zafer Balbag²

¹Sevil Arif Develi Secondary School

²Eskişehir Osmangazi University

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Personal Professional Development Efforts of Science and Technology Teachers in their Fields

Ayşegül Bilgin, Mustafa Zafer Balbag

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Abstract

The aim of this study is to examine the personal professional development efforts of science and technology teachers in their fields with regard to some variables. These variables were determined as gender, year of seniority and sufficiency level of the laboratory equipment. Moreover, the relation between the actual efforts exerted by science and technology teachers and the ideal level of efforts to be exerted by them for personal professional development in their fields was examined. In this study, survey model was applied. Research population was composed of science and technology teachers working in the central district of Eskişehir, a province in Turkey. Sampling was not made and it was attempted to get in contact with all 189 teachers covered in the population. However, data could not be obtained from some teachers and therefore, sampling of the study consisted of 130 teachers. As a data collection tool, "Scale of the Personal Professional Development Efforts of Science and Technology Teachers in their Fields" developed by the researchers was utilised in the research. In the comparison by gender, independent samples t-test was utilised while Anova was used in the comparison by the year of seniority and sufficiency level of the laboratory equipment. When the results of the research are examined, it is seen that female teachers use communication skills more effectively than male teachers. Also, as the senior years of teachers increased, the frequency of using and updating the technology decreased.

Introduction

Aim of the teaching profession is to ensure that the future generations are raised as constructive, creative, good individuals, beneficial for his/her family and environment (Murray, 2012). Professional success of teachers and raising successful individuals are important for the construction of a better future for our country and for the promotion of economic welfare (Tekişik, 1987). This can be achieved only through training good teachers who are at the core of the quality of the education system (Wössmann, 2002; Nye, Konstantopoulos, & Hedges, 2004; OECD, 2005; Hanushek, 2008). Especially from the first day of their professional life, teachers are expected to refresh their knowledge continuously, keep up-to-date, and realise the tasks and responsibilities required to be a contemporary teacher (Darling-Hammond, 2006; Cochran-Smith & Lytle, 1999). Surely, a teacher who cannot adapt oneself to changes will not be able to contribute to the change of his/her students. According to Özkan (2003), personal development is the self-improvement process of an individual to advance or achieve his/her targets and objectives. Personal development is the positive advancement of an individual. As a person constitutes a whole intellectually, emotionally and stylistically, he/she also advances as a whole during his/her development process (Özkan, 2003; Çoruk, 2007). Bayram (2010) defines the professional development of the teachers as an activity or process aiming to create a positive effect on knowledge, skills and behaviours. Özden (2001) explains the primary objective of the professional development as keeping up-to-date and learning the necessary competences to better perform a profession, and improving the knowledge, skills and behaviours required for that profession. Professional development of an individual affects himself/herself, his/her organisation as well as his/her colleagues. Individual's adaptation to the developments and to the changes in his/her job and efforts to better perform his/her duties as well are addressed under the professional dimension of personal development.

Ercan (2010) summarises the four main dimensions addressing the professional development in general as follows:

- "Personal Development" covers communication skills, stress, time management and similar activities.

- “Field-based Development” involves the acquisition and improvement of the knowledge and skills required for the field.
- “Organisation-related Development” covers individual’s being informed about his/her organisation and its functioning; and the importance of feeling a being part of the organisation. Through this dimension, organisations may be ensured to provide a more qualified service.
- “Educational Development” is a dimension based on the improvement of the in-class performance of the instructor.

As stated in the study carried out by Ercan (2010) professional development has to cover certain dimensions. It is noted that personal development, one of these dimensions, is closely related with professional development. Considering that personal development covers communication skills, stress and time management, and similar attributes, development of these qualifications has a positive effect on the professional development of teachers. The reason is that the concepts addressed under personal development are all related to classroom management skills, required to be observed among teachers. In line with the improvement of these skills, teachers will enhance their professional development and will also gain professional experience. Accordingly, this experience will enable teachers to provide their students with more effective and efficient learning options. Therefore, these two almost interwoven concepts set forth the concept of personal professional development. Personal professional development is a concept pointing to the activities required to be undertaken by the teachers personally, in order to advance in their professions and to eliminate their professional shortcomings (such as reading Turkish or foreign books related to their fields of study, watching national or international TV programmes, and attending seminars, etc.)

Teaching means ensuring a relatively permanent change in the individual’s behaviours (Fidan, 2012). Upon the beginning of the first course, the education and training process starts in schools. Teachers who are among the most crucial parts of a school bear the responsibility of ensuring that the students benefit from this process. In order to facilitate the learning of the students and enable them to be successful in this process, teachers should provide the stimuli to ease learning in the educational environment. There are many definitions of the teaching profession. According to Erdem (1998), “teaching is a profession having contemporary, cultural, scientific and technological dimensions, based on field-specific expertise, knowledge and skills; and requiring continuous refreshment of the knowledge and professional practice.” Özbay (2008) stated three main conditions to be able to perform the teaching profession. These are listed as having field information about a specific field, knowledge and skills required to transfer this information to others, and personal characteristics to satisfy these two conditions together. Accordingly, if teachers bearing important duties in this sense cannot develop themselves, it is clear that they will fall behind the times and will not be of great benefit to their students and the society. Especially from the first day of their professional life, teachers should refresh their knowledge continuously, keep up-to-date, and realise the tasks and responsibilities required to be a contemporary teacher.

There are certain actions to be taken by each teacher qualified as contemporary. Öztop (1994) describes the actions which should be taken by a teacher to develop himself/herself both personally and professionally as follows: enhancement of the required academic knowledge; participation to in-service training courses, seminars, conferences, panels; utilisation of technology in every field of life; keeping up-to-date with the publications related to his/her profession and the current agenda; reading to have knowledge about philosophy and arts; personal development; ensuring coordination between the schools and other organisations; and communicating and interacting with his/her colleagues and students.

Cunningham and Turgut (1996) defined the characteristics of an effective science teacher, and accordingly he/she:

- promotes learning in the class and encourages good relations among the students, by being intimate,
- is creative,
- is informed about the content of the natural sciences, understands and applies its principles,
- associates the content of the science classes with the interests and experiences of the students, develops and encourages project work,
- assesses and expresses opinion about the current teaching practices; organises the work properly either as individually or in groups,
- applies various teaching practices according to the student groups,
- has the sufficient communication skills to enable students understand the science issues and interact with the scientific materials,
- ensures a balance among the scientific activities of different types (oral, written or applied),

- provides an active learning atmosphere for students,
- plans and orders science teaching,
- carries out the necessary measures to determine and assess the science learning of the students,
- works individually or in small groups and has the teaching skills,
- encourages students to ask questions of “How?, Why?, What if ...?”,
- guides students to make explanations about the events by considering the cause and effect relations,
- safely plans experimental researches in the laboratory,
- associates out-of-class natural events with the science issues.

Although university education on teaching means being a qualified teacher, it is controversial whether this will be sufficient in the forthcoming years. Therefore, it is necessary that the teachers maintain their education while also working actively (Glathorn, Jones & Bullock, 2006). It is known and mentioned in various platforms in our country that the teachers should develop themselves. In the literature, there is not a sufficient number of scientific studies examining whether this can be achieved by the teachers or not. There is not any sanction in this regard for the teachers and similarly, the reward mechanism is not functioning effectively. Depending on this, it is up to conscience of teachers, who are one of the most important and effective parts of education, to achieve the objectives of enabling students to catch up with the era, opening up their horizons, encouraging and guiding them. As a result of the limited number of researches on the personal development and competences of students, it has been concluded that the level of personal development and professional competences of teachers is insufficient (Öztop, 1994; Balbağ, Yenilmez & Turgut, 2017). However, there is not any comprehensive study on the scope of these deficiencies.

Purpose of the Research

This research aims to determine how the personal professional development efforts of science and technology teachers in their fields change according to the variables of gender, year of seniority and sufficiency level of the laboratory equipment. Moreover, the relation between the actual efforts exerted by science and technology teachers and the ideal level of efforts to be exerted by them for personal professional development in their fields was examined. The scale utilised in this study was developed by us and the stages of this development process was published in another study (Bilgin & Balbağ, 2016). Therefore, this study was carried out as an application of another previously-developed scale. However, the results of the application dimension of this scale are rather important, as it provides information about the personal professional development of science and technology teachers in Turkey. By this means, it is considered that measures to promote the personal professional development of science and technology teachers may be taken. In this research, with the aim of determining the personal professional development efforts of science and technology teachers in primary schools, the variables of gender, year of seniority and sufficiency level of the laboratory equipment were examined by the below given sub-dimensions:

What is the difference among the scores of

- educational and cultural backgrounds,
- specialisation,
- keeping up-to-date with scientific developments,
- keeping up-to-date with technological developments,
- keeping up-to-date with the curriculum,
- keeping up-to-date with the media and publications, of science and technology teachers,
- How is the relation between the actual efforts and the ideal level of efforts of science and technology teachers for personal professional development in their fields?

In this research, the variables of gender, year of seniority and sufficiency level of the laboratory equipment were addressed and their differentiation was examined as per six sub-dimensions of the scale. These variables were selected specifically on purpose. The variables of gender and year of seniority were selected to be examined due to the feeling of burnout observed among the teachers in practicing their profession. The feeling of burnout may differ among people, by gender and by age. A research carried out by Ergin (1992) revealed that the feeling of burnout is more intense among women than men, and with regard to the personal achievement dimension, the idea of personal achievement is more intense among men than women. The feeling of burnout among teachers may be considered as an example of negative reaction to difficult teaching conditions, undisciplined students,

teaching circumstances and lack of support by the management (Tümkiye, 1996). Moreover, factors such as disciplinary problems related to students, insensitivity among students, crowded classrooms, undesired appointments, role conflicts, and criticisms against the teachers may also lead to the feeling of burnout among teachers (Farber, 1984). This feeling negatively affects the personal health of the teacher as well as the education process by causing troubles in the services provided to students (Baysal, 1995). Results of the feeling of burnout may be exemplified as neglecting of work, increasing tendency to quit work, deterioration of service quality, absenteeism without any permission, tendency to extend the duration of leave by receiving health report, worsening of the work or personal relations, unconformity, alienation to family members or to spouse, job dissatisfaction, tendency to feel sick groundlessly, increase in work accidents, etc. (Çam, 1992) The research carried out by Akçamete, Kaner & Sucuoğlu, (1998) revealed a high level of relation between job satisfaction and the feeling of burnout. High level of enervation and a motivation are observed among those experiencing dissatisfaction in the workplace. A motivation means the interruption of the professional development by teachers such as through nonchalance, in a way to negatively affect their students and themselves. From this perspective, gender and year of seniority are two different variables concerning the professional development of teachers. Moreover, considering the number of science and technology teachers in Turkey, it is seen that the number of female teachers is higher than that of male teachers (MEB, 2015). This may be interpreted that the desire and motivation to become a teacher are higher among women than men. In this regard, it was considered that the variable of gender may lead to a difference in terms of personal professional development. Sufficiency level of the laboratory equipment of the schools is another variable addressed in this study. In the previous years, laboratory practices in schools used to be carried out to prove the accuracy of the scientific information, but in the recent years, laboratories have begun to be considered as places where new information is discovered, and where research-based learning takes place (Hofstein & Lunetta, 1982). When laboratories are available in schools and when they are well-equipped, teachers may further develop their present skills and promote their personal development through various experiments and practices they will design. Therefore, we consider that this variable should be addressed in relation to professional development. Indeed, according to the research results, sufficiency level of the laboratory equipment of the schools affects the professional development of science and technology teachers. Besides, as the scale has a parallel structure in this study, the relation between the actual efforts and the ideal level of efforts of science and technology teachers for personal professional development in their fields was also examined. Although there are many studies for personal professional development, the key to this study is a detailed study of the personal professional development of science teachers' fields.

Method

Research Model and Universe Sample

This research was prepared on the basis of a survey model as it aims to determine the personal professional development efforts of science and technology teachers. "Scale of the Personal Professional Development Efforts of Science and Technology Teachers in their Fields" developed by the researchers (Bilgin & Balbağ, 2016) was utilized in the research. This scale is composed of 6 sub-dimensions and 27 items. Sub-dimensions are educational and cultural backgrounds, specialization, keeping up-to-date with scientific developments, keeping up-to-date with technological developments, keeping up-to-date with the curriculum and keeping up-to-date with the media and publications, respectively. Internal consistency Cronbach Alpha co-efficient of the scale varies between .64 and .83. Cronbach Alpha co-efficient in the overall scale is .82.

Research population is composed of science and technology teachers working in the primary schools in the central district of Eskişehir, in 2011-2012 school years. Sampling was not made and it was attempted to get in contact with all 189 teachers covered in the population. Population covers 189 science and technology teachers. To address quantitatively sufficient amount of data in the research, sampling was not performed and all the science and technology teachers in these schools were tried to be contacted. However, it was not possible to benefit from the whole population due to difficulties in transport, existence of teachers on leave, lack of willingness of some teachers. Therefore, research population was composed of 130 science and technology teachers. 82 female and 48 male science teachers participated in the research. This study constitutes a part of a post graduate research in the field of physical sciences. Accordingly, this research tried to set forth the personal professional development efforts of science and technology teachers. In developing the scale, items of the scale were shaped on the basis of the feedback from science and technology teachers. When required, the scale may be adapted to other branches of teaching. Research was carried out in Eskişehir, a province of Turkey. Eskişehir was selected as the level of quality and success in education activities there is higher in this province than the average of Turkey, and as it is located in the Central Anatolia Region, just in the middle of Turkey. Moreover,

the mentioned post graduate thesis is carried out in a university in Eskisehir, Eskisehir is a more secure province in comparison to many other provinces in Turkey, educational activities in this province are carried out rather properly, and the data collection is cheaper and easier than in any other province. Table 1 presents the population and sample of the central district of Eskisehir, where the research was carried out.

Table 1. Demographic characteristics of the teachers in the sample

Variables		n	%
Gender	Female	82	63.1
	Male	48	36.9
Year of seniority	5 years and below	26	20
	6 - 10 years	30	23.1
	11 - 15 years	26	20
	16 - 20 years	16	12.3
	21 years and above	32	24.6
Sufficiency level of the laboratory equipment	Very Well	15	11.9
	Sufficient	73	57.9
	Insufficient or absent	42	30.2
	Total number of teachers	130	100

Table 1 displays the demographic characteristics of the teachers participating in the research. The variables here are gender, year of seniority and sufficiency level of the laboratory equipment.

Data Collection Tool

In this study, "Personal Professional Development Efforts Scale for Science and Technology Teachers Regarding Their Fields" was used. The scale developed by the researchers is in the form of a parallel form, and it has been prepared in a way to include the questions for science and technology teachers which request them to assess their personal professional development regarding their fields both ideally and personally in the same question. 5 point likert type grading is used in the scale. This grading is as follows: "Always (5), often (4), sometimes (3), rarely (2) and never (1)". Language and meaning validity study on Personal Professional Development Efforts Scale for Science and Technology Teachers Regarding Their Fields has been conducted by three voluntary Turkish teachers working in primary school. Study on content validity of the scale has been prepared by voluntary experts working as lecturers in primary education department of education sciences at education faculty of the university, 4 of whom are working in the curriculum and measuring-evaluation department at education sciences, and 5 of whom are working in primary school, math and science division at primary education department. The scale has been observed through varimax rotation method composing of 6 factors and 27 items. Mentioned factors are educational and cultural knowledge, specialisation, following scientific and technological developments, following curriculum, following media and publications. Internal consistency of 5 point likert scale has been determined with Cronbach Alpha coefficient. Cronbach Alpha coefficient of the sub-dimension scale ranges between .64 and .83, which is .82 throughout the scale. Depending on these, it can be stated that data collection tools are valid and reliable. This work is important in terms of scale in schools as it is the first application. The sub-dimensions of the scale of personal professional development efforts towards Science Teachers' Fields; Educational and cultural background, specialisation, keeping up-to-date with scientific developments, keeping up-to-date with technological developments, keeping up-to-date with the curriculum, keeping up-to-date with the media and publications and it is considered that the coverage of the scale with sufficient number of items belonging to sub-dimensions is high. It is thought that the construct validity of the measurement tool is high because the answers given by science teachers to the data collection tool can give a general impression of the level of personal professional development efforts.

Analysis of Data

Scales filled in by science and technology teachers in the primary schools in the central district of Eskişehir were examined one by one. The data obtained accordingly were examined by the genders, years of seniority of the teachers and the sufficiency level of the laboratory equipment of their schools. Statistical analyses were carried out through SPSS (Statistical Package for the Social Sciences) 18 package programme.

During the statistical analysis, firstly the normal distribution of data was addressed through Kolmogorov-Smirnov. Then, independent sample t-test was applied for variables with two categories and one-way ANOVA

for variables with three or more categories. The differences between the groups in the result of the ANOVA test were determined using the Scheffe test. Lastly, correlation was established to examine the relation between the personal professional development expected to be observed in an ideal science and technology teacher and their actual personal professional development in their fields.

Findings

According to the results of Kolmogorov-Smirnov tests realised, there is a normal distribution of data and the variables are homogeneous. Accordingly, sub-problems were tried to be answered through independent sample t-test which was used to make comparisons by gender, scores obtained in the data collection tools, and one-way ANOVA which was used to make comparisons by the year of seniority, and the sufficiency level of the laboratory equipment. Moreover, correlation was established to examine the relation between the personal professional development expected to be observed in an ideal science and technology teacher and the actual personal professional development in their fields.

Examination of the Variable of Gender of the Science and Technology Teachers by the Sub-Dimensions

Variable of gender of the science and technology teachers was examined by sub-dimensions. Accordingly, there is not a statistically significant difference ($p > .05$) between the averages of the scores of educational and cultural backgrounds, specialisation, keeping up-to-date with scientific developments, keeping up-to-date with technological developments, keeping up-to-date with the curriculum and keeping up-to-date with the media and publications both for female and male teachers. Table 2 presents the results of the analysis.

Table 2. Examination of the variable of gender of the science and technology teachers by the sub-dimensions

Sub-dimensions	Gender	<i>n</i>	<i>X</i>	<i>SS</i>	<i>t</i>	<i>p</i>
Educational and cultural background	Male	48	19.45	3.99	-.45	.64
	Female	82	19.78	3.77		
Specialisation	Male	48	14.81	4.80	-.78	.43
	Female	82	15.54	5.35		
Keeping up-to-date with scientific developments	Male	48	20.06	3.03	-1.78	.07
	Female	82	20.95	2.55		
Keeping up-to-date with technological developments	Male	48	11.85	2.32	.16	.86
	Female	82	11.79	1.78		
Keeping up-to-date with the curriculum	Male	48	11.66	2.35	-2.60	.01
	Female	82	12.64	1.88		
Keeping up-to-date with the media and publications	Male	48	9.79	2.09	-.25	.80
	Female	82	9.87	1.74		

$p < .05$

It may be stated that the gender variable does not differ by these sub-dimensions. However, in terms of the sub-dimension of keeping up-to-date with the curriculum, there is a statistically significant difference ($p < .05$) between the averages of the scores of female and male teachers. Depending on this finding, it may be said that the female teachers communicate more frequently with the teachers in their groups and try to learn more about the acquisitions.

Examination of the Variable of the Year of Seniority of the Science and Technology Teachers by the Sub-Dimensions

Variable of the year of seniority of the science and technology teachers was examined by sub-dimensions. Accordingly, in terms of the year of seniority of female and male teachers, there is not a statistically significant difference ($p > .05$) between the sub-dimension scores of educational and cultural backgrounds, specialisation, keeping up-to-date with the curriculum and keeping up-to-date with the media and publications. Table 3 presents the results of the analysis.

Table 3. Examination of the variable of the year of seniority of science and technology teachers by the sub-dimensions

	Year of Seniority	<i>n</i>	\bar{X}	<i>SS</i>	Var. K.	<i>KT</i>	<i>Sd</i>	<i>KO</i>	<i>F</i>	<i>p</i>	$\frac{GA}{F}$
Educational and Cultural Background	5 years and below	26	19.54	3.50	Inter-groups	25.68	4	6.42	.43	.79	None
	6-10 years	30	20.27	4.06	Intra-groups	1883.42	125	15.07			
	11-15 years	26	19.92	4.59	Total	1909.11	129				
	16-20 years	16	18.88	3.10							
	21 years and above	32	19.38	3.72							
Specialisation	5 years and below	26	13.69	3.39	Inter-groups	83.59	4	20.90	.78	.54	None
	6-10 years	30	15.87	6.31	Intra-groups	3344.44	125	26.76			
	11-15 years	26	15.50	5.28	Total	3428.03	129				
	16-20 years	16	15.69	5.28							
	21 years and above	32	15.63	5.04							
Keeping up-to-date with scientific developments	5 years and below ^a	26	21.92	2.30	Inter-groups	131.73	4	32.93	4.8	.00	a-e, a-d
	6-10 years ^b	30	21.10	2.66	Intra-groups	854.80	125	6.84			
	11-15 years ^c	26	21.08	2.31	Total	986.53	129				
	16-20 years ^d	16	19.56	2.80							
	21 years and above ^e	32	19.28	2.93							
Keeping up-to-date with technological developments	5 years and below ^a	26	12.77	1.66	Inter-groups	43.67	4	10.92	2.9	.02	a-d
	6-10 years ^b	30	11.83	2.23	Intra-groups	469.90	125	3.76			
	11-15 years ^c	26	11.96	2.16	Total	513.57	129				
	16-20 years ^d	16	10.94	1.48							
	21 years and above ^e	32	11.34	1.86							
Keeping up-to-date with the curriculum	5 years and below	26	11.81	2.08	Inter-groups	11.68	4	2.92	.64	.63	None
	6-10 years	30	12.63	2.28	Intra-groups	566.79	125	4.53			
	11-15 years	26	12.19	1.74	Total	578.47	129				
	16-20 years	16	12.63	1.78							
	21 years and above	32	12.25	2.44							
Keeping up-to-date with the media and publications	5 years and below	26	9.85	1.76	Inter-groups	12.57	4	3.14	.89	.47	None
	6-10 years	30	9.73	1.87	Intra-groups	440.35	125	3.52			
	11-15 years	26	10.35	1.92	Total	452.92	129				
	16-20 years	16	9.25	1.61							
	21 years and above	32	9.84	2.05							

GAF: Difference among the Groups

p<.05

It may be stated that the scores of teachers with different years of seniority in these sub-dimensions are close to each other. However, there is a significant difference (p<.05) in terms of the year of seniority between sub-

dimension scores of keeping up-to-date with scientific developments and keeping up-to-date with technological developments. As a result of the Scheffe test carried out to determine the reason of this difference, it was found out that the scores of teachers with 5 years of seniority or below in the sub-dimension of keeping up-to-date with scientific developments are significantly higher than those of the teachers with 16-20 years of seniority or above. Similarly, it was determined that the scores of teachers with 5 years of seniority or below in the sub-dimension of keeping up-to-date with technological developments are significantly higher than that of the teachers with 16-20 years of seniority or above.

Examination of the Variable of the Sufficiency Level of the Laboratory Equipment of the Schools of Science and Technology Teachers by the Sub-Dimensions

In terms of the sufficiency level of the laboratory equipment of the schools of science and technology teachers, there is not a significant difference ($p > .05$) between the sub-dimension scores of keeping up-to-date with scientific developments, keeping up-to-date with technological developments; keeping up-to-date with the curriculum and keeping up-to-date with the media and publications. Table 4 presents the results of the analysis.

Table 4. Examination of the variable of the sufficiency level of the laboratory equipment of the schools of science and technology teachers by the sub-dimensions

	Laboratory	<i>n</i>	\bar{X}	<i>SS</i>	Var. K.	<i>KT</i>	<i>Sd</i>	<i>KO</i>	<i>F</i>	<i>p</i>	$\frac{GA}{F}$
Educational and Cultural Background	Very well ^a	15	22.00	4.36	Inter-groups	116.22	2	58.11	4.12	.01	b-a
	Sufficient ^b	73	19.01	3.49	Intra-groups	1792.89	127	14.12			
	Insufficient absent ^c	or 42	19.95	3.98	Total	1909.11	129				
Specialisation	Very well ^a	15	17.67	7.10	Inter-groups	277.81	2	138.90	5.60	.00	b-a
	Sufficient ^b	73	14.01	3.77	Intra-groups	3150.22	127	24.80			
	Insufficient absent ^c	or 42	16.62	5.88	Total	3428.03	129				
Keeping up-to-date with scientific developments	Very well	15	21.67	2.58	Inter-groups	26.41	2	13.20	1.75	.17	None
	Sufficient	73	20.29	2.82	Intra-groups	960.13	127	7.56			
	Insufficient absent	or 42	20.83	2.68	Total	986.53	129				
Keeping up-to-date with technological developments	Very well	15	11.87	2.23	Inter-groups	.66	2	.33	.08	.92	None
	Sufficient	73	11.75	1.98	Intra-groups	512.91	127	4.04			
	Insufficient absent	or 42	11.90	1.99	Total	513.57	129				
Keeping up-to-date with the curriculum	Very well	15	12.33	2.38	Inter-groups	10.48	2	5.24	1.17	.31	None
	Sufficient	73	12.51	2.05	Intra-groups	567.98	127	4.47			
	Insufficient absent	or 42	11.88	2.13	Total	578.47	129				
Keeping up-to-date with the media and the publications	Very well	15	10.13	2.39	Inter-groups	1.73	2	.86	.24	.78	None
	Sufficient	73	9.85	1.79	Intra-groups	451.19	127	3.55			
	Insufficient absent	or 42	9.74	1.85	Total	452.92	129				

GAF: Difference among the Groups

$p < .05$

Accordingly, it may be stated that the teachers working in schools with different sufficiency levels of the laboratory equipment obtained similar scores in these sub-dimensions. However, in terms of the sufficiency

level of the laboratory equipment there is a significant difference ($p < .05$) between the sub-dimension scores of educational and cultural backgrounds, and specialisation. According to the results of the Scheffe test carried out to determine the reason of this difference, educational and cultural backgrounds, and specialisation scores of the teachers working in schools with a high level of sufficiency with regard to the laboratory equipment are significantly higher than that of teachers working in schools with a sufficient level of laboratory equipment.

Findings Regarding the Relation between the Ideal and Current Condition of the Personal Professional Developments of Science and Technology Teachers in Their Fields

It is observed that the coefficient between the total scores obtained from the test of personal professional development efforts ideally expected from science and technology teachers in their fields, and the total scores obtained from the test of personal professional development efforts currently exerted by science and technology teachers in their field was .41 ($p < .05$). Accordingly, a medium-level, positive and significant relation was determined between the ideal and current condition of the personal professional efforts of science and technology teachers in their fields. Based on this finding, it may be said that in line with an increase in the actual personal professional development efforts of science and technology teachers, they get closer to the ideal personal professional development efforts expected from science and technology teachers in their fields. Table 5 presents the relation between the personal professional development efforts ideally expected from science and technology teachers in their fields, and the current personal professional development efforts of science and technology teachers in their fields.

Results and Discussion

According to the results of the research concerning the sub-dimension of “educational and cultural backgrounds” of science and technology teachers, genders of the teachers are not regarded as a distinguishing factor. Different years of seniority do not lead to a difference in the educational and cultural backgrounds of teachers. However, sufficiency of the laboratory equipment of the schools creates a difference. It is seen that in line with an increase in the sufficiency level of the laboratory equipment, educational and cultural backgrounds are also enriched. Laboratory work enables understanding the nature of science, observing the practices and ensuring a more permanent learning among the students. In the overall world, laboratory work is carried out to introduce and present new information and to ensure conceptual learning (Garnett, 1995). Based on this perspective, laboratory work is important for the science classes. In order to perform practices in science laboratories, teachers should be trained well and put their knowledge into practice in the classes. Quality of the laboratory activities will improve when the teachers actually experience different experiments or develop themselves in this regard. Each practice will constitute experience for the next trial. By this means teachers will be able to design more successful and different experiments. Based on these, it may be said that in line with an increase in the years of seniority and in the number and variety of the experiments, laboratory work may become more efficient. Geçer (2005) carried out a study regarding this issue in his Master's thesis titled “Various Difficulties Encountered in Laboratory Applications in the Science Classes”. It was stated that teachers became distant to the laboratory due to their incompetence in these applications, which turned to unwillingness in students over time. It was also reported that as the year of experience increased and there was a fully equipped laboratory in schools, teachers' confidence in themselves also increased and they started to become interested in laboratory activities.

Differences between the genders and years of seniority of the science and technology teachers do not lead to a difference in the sub-dimension of “specialization”. However, different sufficiency levels of laboratory equipment of the schools create a difference. It is observed that in line with the increase in the sufficiency levels of laboratory equipment of the schools, teachers specialize more in their fields. A teacher working in a well-equipped school may desire to develop himself/herself more. By this means, teachers may feel themselves more effective and successful. According to the master's thesis of Ülgener (2010) titled “Obstacles faced by Science and Technology Teachers during their Practices”, nearly 19% of the teachers marked in the survey that they cannot practice laboratory work. This high ratio is distressing for both science teachers and students. In order to diminish this ratio, self-development of the teachers in their fields is very important. In this study, it was observed that 95% of the schools in the research sample have laboratories. The cases that teachers cannot practice laboratory work in schools with sufficient and highly sufficient laboratory equipment may be interpreted as the result of incompetency and lack of knowledge of the teachers in this regard. In his paper on “the basic problems of our primary education”, Demirtaş (1988) highlighted the importance of the environment and tools in instructional practices. According to Demirtaş, the problems that should be addressed in terms of

instruction included arranging the instructional environment, obtaining instructional tools, and making sure that these tools appeal to students and can be easily understood.

In terms of the sub-dimension of “keeping up-to-date with the scientific developments”, gender and the sufficiency of laboratory equipment do not create a difference. However, different years of seniority lead to a difference. Accordingly, teachers with 5 years of seniority or below attach more importance to keeping up-to-date with scientific developments. In other words, in terms of the sub-dimension of “keeping up-to-date with the scientific developments teachers with 5 years of seniority or below are more successful than teachers with 6-10 years, 11-15 years, 16-20 years, 21 years of seniority and above. It may be stated that in line with an increase in the year of seniority, the desire to keep up-to-date with the innovations decreases. The reason of this may be the feeling of burnout increasing in time and the inadequate promotion and reward mechanisms. Avcı and Seferoğlu (2011) obtained similar results in their study on the feeling of burnout among the teachers in the information society. It is stated that one of the reasons of the lack of technology literacy among the teachers is related with the feeling of burnout. In his/her study, Ünal Bozcan (2010) reported that the difference in the use of technology among male and female teachers was in favour of the male teachers, which contradicts the results of the current study.

In the sub-dimension of “keeping up-to-date with the technological developments” of the science and technology teachers, gender and the sufficiency of laboratory equipment do not create a difference. However, teachers with 5 years of seniority or below keep up-to-date with the technological developments more than the other teachers. In line with an increase in the years of seniority, the level of keeping up-to-date with the technological developments decreases. Today, in an era of communication and information, it is important to be able to use computer, be informed through internet and make researches in the internet. Moreover, being informed and keeping up-to-date with the technological developments are also important for catching up with the era. According to the master’s thesis of Avcu (2011) on the acceptance and usage tendency of the secondary school teachers towards the Information and Communication Technologies (ICT), anxiety level of the teachers with 6-11 years of seniority or above for ICT is higher than that of teachers with 1-5 years of seniority or below. It may be stated that teachers with fewer years of seniority consider themselves more competent and desirous in the fields related with technology. It is observed that the results of this research are in line with the mentioned research. In his study on the relationship between educational administrators’ attitudes towards computers and their self-efficacy, Baltacı (2008) found that the administrators whose year of service was 16 years or less had higher levels of using information and communication technologies than those whose year of service was 21 years and above. Besides, the administrators who worked for 10 years and less differed within their group, and as the year of service increased, the level of using information and communication technologies decreased.

Within the scope of the sub-dimension of “keeping up-to-date with the curriculum” of the science and technology teachers, year of seniority of the teachers, and the sufficiency of laboratory equipment do not constitute a distinguishing factor. However, findings point out that the scores of female teachers for keeping up-to-date with the curriculum are higher than male teachers. The study of Özabacı and Acat (2005) on the perception of personal features related with the teaching profession and the level that the teachers have these features indicated that female teachers attach more importance to communication skills. Nacar (2010) also obtained similar results in his research on the communication and inter-personal problem solving skills of the class teachers. Female teachers benefit from communication skills more, as they compare themselves with the other teachers and as they have acquired women’s role since the childhood.

In terms of the sub-dimension of “keeping up-to-date with the media and publications” of the science and technology teachers, differences in the gender and years of seniority of the teachers and differences in sufficiency of laboratory equipment of the schools do not create a difference. In other words, fields related with the media and publications do not constitute a difference among the teachers. The sub-dimension of keeping up-to-date with the media and publications covers watching national/foreign television programmes related with the field of work of the teachers, and keeping up-to-date with the scientific periodicals. Accordingly, within this framework, the fact that there is no difference among the teachers in terms of gender, year of seniority and different sufficiency levels of laboratory equipment may be addressed in another study. A large majority of the teachers may not be watching national/foreign television programmes related with their fields, or may not be keeping up-to-date with the scientific periodicals. Moreover, knowledge of a foreign language may also have an effect on this topic. In her Master’s thesis titled “Teachers’ Views on the Necessity of Foreign Language Education”, Karakuş (2010) stated that foreign language education was necessary to follow technological developments. It was reported that the teachers found foreign language education necessary for professional development. There is a medium-level, positive and significant relation between the personal professional

development efforts ideally expected from science and technology teachers in their fields, and the current personal professional development efforts of science and technology teachers in their fields.

Conclusion

When the findings of the research are considered in general, a significant difference is observed between the genders of the teachers and their scores of keeping up-to-date with the curriculum; year of seniority and the scores of keeping up-to-date with the scientific developments; the sufficiency level of the laboratory equipment of the schools and the scores of educational and cultural background and the scores of specialization. A medium-level, positive and significant relation is observed between the ideal and current condition of the personal professional efforts of science and technology teachers in their fields.

Accordingly, it is observed that in line with an increase in the personal professional development efforts of teachers in their fields, they get closer to the personal professional development efforts ideally expected from science and technology teachers in their fields. This can be interpreted as the result of a parallel improvement in the experience with the enhancement of the personal professional development in their fields, and the increase in self-confidence in a way to better promote self-development. As a result of the research, it is seen that female teachers use communication skills more effectively than male teachers. Also, as the senior years of teachers increased, the frequency of using and updating the technology decreased. Moreover, teachers working in schools with very well equipped laboratories are more interested in their field, and more desirous to specialize in their fields. This study will set a precedent for the examination of the personal professional development efforts of science and technology teachers in their fields and will be beneficial in revealing and improving the defective aspects of the Turkish education system.

Recommendations

In accordance with the findings obtained from the research, the below recommendations could be given:

- Promotion and reward mechanisms for teachers in the Turkish national education should be reviewed and re-structured in an aim to improve personal professional development in their fields.
- Efficient and effective in-service trainings on the rapidly changing technology and its utilisation may be provided to teachers. These trainings may be rendered more actively.
- Personal Professional developments of teachers in their fields may be examined on the basis of different variables.

Note

This study has been generated by Ayşegül Bilgin from Master's Thesis "Personal Professional Development Efforts of Science and Technology Teachers Regarding Their Fields" submitted at "Institute of Educational Sciences, Eskişehir Osmangazi University" in 2014.

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Author Information

Aysegul Bilgin

Sevil Arif Develi Secondary School
Eskisehir, Turkey

Mustafa Zafer Balbag

Eskişehir Osmangazi University
Faculty of Education, Eskişehir, Turkey
Contact e-mail: zbalbag@ogu.edu.tr
