Determining In-Service Training Needs of Physics Teachers for Inquiry Based Curricula

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Abstract
The aim of this study was to determine the in-service training needs of physics teachers for the inquiry-based curricula. The survey method was used in the research. In-Service Training Needs Determination Questionnaire for Physics Teachers developed by the researchers is consist of three components, demographic information and teaching profession knowledge, physics teaching in Likert scale. The questionnaire was applied to the probability sampling. A total of 374 physics teachers participated in the survey. The teachers participating in the survey has been affiliated schools in the Ministry of National Education (MoNE) in Turkey. The result of data analysis shows that the physics teachers need to be introduced to current teaching methods and techniques such as workshop and argumentation. This study showed that the teachers need in-service training that the subject of equipping cognitive skills such as critical and creative thinking in students. This study offers suggestions to increase the effectiveness of in-service trainings.
Keywords: Physics Teacher, Inquiry-Based Curricula, In-Service Training

Introduction

Continuity in social growth and advancement needs lifelong education of society's members. Rapid developments in technical and social sectors have an effect on people' educational experiences on their path to obtaining a career, as well as on their professional circumstances. In this context, improving the efficiency and effectiveness of people in service is accomplished via the organization of in-service training (IST) programs aimed at enriching their knowledge, abilities, and attitudes (Taymaz, 1997).

Each culture creates its own educational system in order to grow. Teachers are responsible for putting a state's education policy into reality, for influencing that policy via the execution of that policy, and for revealing the kind of intellectual that society desires (Taymaz, 1997; Özyürek, 1981). Teachers who bear this responsibility must commit to lifelong learning in order to gain the information and skills required to fulfill their personal, professional, and societal demands. All teachers are required to keep abreast of developments in their areas and to make an effort to study and create innovative teaching techniques in this regard.

Theoretical Framework

Among the primary objectives of physics education, like in other fields, are to achieve meaningful and effective learning and to prevent courses from becoming monotonous. To do this, topics and ideas should be connected to everyday life and events, as well as breakthroughs and advancements in science and technology (Çepni et al., 1997). Lessons should be conducted using student-centered modern approaches that engage students. Despite this, research indicates that many teachers still use the conventional approach to construct their instructional settings. The teacher is the active lecturer in the traditional approach, whereas the student is the passive listener (Altundaş, 2013; Ergin & Sarı, 2013; Karakış, 2006). Additionally, in a study stating that physics teachers tend to use traditional methods, it was stated that the repetition of the subject as a result of the spiral structure of the curriculum is a waste of time and that teachers use a behavioral learning approach rather than a constructivist approach in their teaching activities (Ayvacı & Devecioğlu, 2013). It was highlighted that in order to execute the physics lesson curriculum successfully and efficiently, teachers should be grouped into IST courses that include a variety of current teaching methods and strategies that allow students to learn meaningfully (Sadi & Yıldız, 2012). Because research indicates that physics teachers who have acquired IST are capable of teaching successfully when they use contemporary teaching methods and approaches (Grace et al., 2015; Altundaş, 2013).

It is well established that IST activities are efficient in bridging the divide between theoretical and practical knowledge (Özyürek, 1981). It is claimed that it is helpful for teachers to attend IST when they begin their careers, in terms of adapting to their institutions and putting what they learnt in pre-service training into practice (Kaya, 2003). Changes and changes throughout time have necessitated the need for IST, both for newly hired teachers and for those who have spent years in this field. Accurately meeting this requirement involves finding the required points. IST programs may be successful if they are built on the findings of a thorough needs assessment (Kaya, 2003; Kanlı & Yağbasan, 2001; Taymaz, 1997; Neil, 1986).

Changes have an effect on one another in the emerging world. This connection allows fast dissemination of changes across all domains. This situation requires curriculum revisions. When the modifications to Turkey curriculum are reviewed, it is clear that the constructivist approach to learning has been used as a foundation since 2004. The purpose of these modifications is to resolve issues and remove inadequacies, as well as to develop competent people with advanced thinking abilities. In this direction, MoNE adopted the physics course curriculum in 2013. The curriculum emphasizes students' development in the affective and psychomotor domains concurrently with their mental development (Göçen & Kabaran, 2013; MoNE, 2013).

The Ministry of Education released the revised Physics Curriculum in 2018. The Ministry of National Education says in this article that no significant modifications were made to the curriculum and that programs were evaluated and revised in light of the findings. When the broad goals of the 2013 and 2018 Physics Curriculums are compared, both programs' aims coincide. As can be observed, many of the 2013 curriculum's emphases were carried over to the 2018 curriculum. For example, some of the general objectives of the 2013 Physics Curriculum are stated as follows;

- To understand the nature of scientific inquiry, to produce scientific knowledge using scientific process skills and to solve problems.
- To use scientific knowledge and methods to explain an event and apply it to new situations.
- To justify and evaluate claims based on evidence and proof, and to share scientific knowledge.

The points emphasized in these purposes are stated in the general objectives of the 2018 Physics Course Curriculum as follows;

- It is aimed that students understand the nature of scientific inquiry.
- It is aimed that students produce scientific knowledge, solve problems and share scientific knowledge by using their scientific process skills.
- It is aimed that students obtain data by doing experiments, make inferences using these data, interpret them and reach generalizations.
- It is aimed that students can use their research, questioning, examination and critical thinking

skills, which are a requirement of the information age, in all areas of life.

Teachers who have one-on-one interaction with students are important in ensuring that programs achieve their objectives. Studies demonstrate that the qualities of physics teachers have a positive impact on students' performance in physics courses, their attitudes and motivations toward physics courses (Claessens et al., 2016; Bereketoğlu, 2002; Korur, 2001; Darling-Hammond, 2000; Aiello-Nicosia et al., 1984). However, issues have been identified in studies on the teaching techniques and activities of physics teachers. The new curriculums are based on modern teaching techniques that put the learner first such as active learning, argumentation, and workshop. However, research indicates that teachers favor traditional techniques such as narrative and question-and-answer to create classroom settings (Ersoy & Dilber, 2015; Altundaş, 2013; Karal Eyüboğlu, 2011; Şengül, 2007; Oğuz, 2005; Kaya, 2003). Additionally, Akdeniz and Paliç (2012) discovered that the majority of teachers were unable to properly implement the curriculum because they lacked sufficient understanding of the program's framework and instead taught physics using their own knowledge, abilities, and perspectives. Ayvacı and Devecioğlu (2013) assert that there is no agreement between those responsible for developing the physics course content and those responsible for implementing it. The researchers ascribed this scenario to the program not being well presented to teachers and the ISTs provided to teachers being inadequate.

To resolve issues that arise throughout the education-teaching process, it is essential to first recognize the issues, inadequacies, and challenges that arise. Studies on the topic indicate that execution of the physics course curriculum is problematic (Ersoy et al., 2018; Karal Eyüboğlu, 2011). Additionally, it has been claimed that the involvement of teachers as educators and trainers in well-structured IST is helpful in resolving practice-related issues (Yiğit & Altun, 2011). In this context, IST is required for the revision of the physics teacher education curriculum (Akdeniz & Paliç, 2012).

Considering branch variations, academic background, requirement determination, and instructional techniques while designing the IST to be produced improves the IST's efficiency (Gökdere & Küçük, 2003). The research concluded that an IST application based on inquiry-based teaching, in which a variety of approaches, strategies, and materials are utilized rather than a monotonous IST, would provide positive outcomes. In addition, it is essential to building a culture of using research-informed teaching methods to improve education and support their students' learning and motivation in science (Frågåt et al., 2021). It is clear that the updated 2013 and 2018 Secondary Education Physics Curriculums has been based on research-informed teaching. To ensure the effectiveness of the updated physics teaching programs, it would be desirable to educate physics teachers about them and to develop an IST program that would favorably influence teachers' attitudes and views about the program (Ceran Çifci, 2008; Durmuş, 2003). The first stage in conducting a planned IST research is establishing the IST need. To develop a successful and efficient IST program, it is essential to ascertain the viewpoints and requirements of teachers. The study issues were defined in response to the necessity for research on teachers in order to successfully execute the revised secondary school physics curriculum. In this sense, the primary issue addressed by this study is as follows:

"What IST needs do physics teachers have in light of the inquiry-based curricula?"

The sub-problems addressed by the study that will be conducted within the scope of this fundamental issue are as follows:

"How do teachers' thoughts on in-service training?"

"How do teachers' needs about teaching profession knowledge?"

"How do teachers' needs about physics teaching?"

Methodology

The survey model is defined as a survey on the sample to be taken from the entire population or the sample to be taken from the population. The surveys is used frequently in educational research (McMillan & Schumacher, 2006; Karasar, 2000). In this research a survey was conducted to ascertain factual quantitative data.

The Ministry of Education released the revised Physics Curriculum in 2018 while the study process was ongoing. Upon examination of the new program's gains, it is discovered that just two gains have been changed, with no additional or subtracted benefits. According to the findings of the research "Comparison of the 2013 and 2018 Secondary Education Physics Curriculums in Turkey in Terms of Basic Aspects," released in 2020 by Bezen et al., many fundamental elements of the 2013 and 2018 Secondary Education Physics Curriculums are shared. Despite the fact that it is based on the 2013 Secondary School Physics Curriculum, the findings of the present study are believed to be consistent with the 2018 curriculum. It is anticipated that the in-service training programs developed in response to the findings of the present study will aid teachers in effectively implementing the 2018 Physics Curriculum.

Sample

Within the scope of the survey probabilistic sampling was employed. Probabilistic sampling is a technique used in quantitative research that entails selecting a large number of randomly selected people from a subset of a population (Karasar, 2000). The survey's universe consists of 11193 physics teachers employed by MoNEs across Turkey. This figure is derived from data compiled by the General Directorate of Teacher Training and Development, which is connected with the Ministry of National Education and was last updated on 17.04.2017. This number was calculated as follows: mean estimated deviation d=0.05; estimated standard deviation 0.5; confidence level 0.95; t=1.96 according to the confidence level; When the PQ value was set to 0.5, the sample size was determined to be 317. This figure corresponds to the number of samples computed on the basis of the number of survey questions.

Table 1 Distribution of Physics Teachers Participating in the Survey by Provinces

CITYS	f	%*	Citys	f	%*
Muğla	84	22,5	Ankara	7	1,9
Kahramanmaraş	75	20,1	Amasya	5	1,3
Giresun	40	10,7	Kars	2	0,5
Ordu	36	9,6	Malatya	1	0,3
Erzurum	35	9,4	Adana	1	0,3
Sivas	33	8,8	Isparta	1	0,3
Samsun İstanbul	20 13	5,4 3,5	Artvin İzmit	1 1	0,3 0,3
Çorum	10	2,7	İzmir	1	0,3
Rize	7	1,9	Uşak	1	0,3
			Total	**374**	**100**

*Percentage totals may differ from hundred due to rounding off decimals to the nearest number

The 'In-service training requirements determination questionnaire for Physics teachers', which was created as an e-form on the internet, was sent to the Provincial Directorates of National Education in Muğla, Kahramanmaraş, Sivas, Erzurum, and Rize. Additionally, teachers of physics from other regions of Turkey who could be contacted individually participated in the online survey. The study gathered data from 377 physics teachers. After eliminating the three surveys that were determined to be invalid, the remaining 374 questionnaires were analyzed. Table 1 shows the province-by-province distribution of physics teachers who participated in the survey. Table 2 summarizes the demographic characteristics of the participants.

Table 2 Demographic Characteristics of Teachers

Demographic Characteristics		f	%
Gender	Female Male	148 226	39,6 60,4
Task	Executive Teacher	32 342	8,6 91,4
Type of school served	Science High School Anatolian High School Vocational high School Other	32 221 114 7	8,5 59,1 30,5 1,9
Total length of service in the teaching profession	0-5 years 6-10 years 11-15 years 16-20 years 21 years and more	56 74 63 50 131	15 19,8 16,8 13,4 35
School or program of teacher education	Faculty of Education Formation Certificate Program Non-Thesis Master's Program	205 96 31	54,8 25,6 8,3
School or program of teacher education	Faculty of Arts and Sciences Masters with thesis Institute of Education	35 6 1	9,4 1,6 0,3
Number of participations in in-service training on subjects related to the teaching profession*	None 1-2 3-5 6 and more	42 101 181 48	11,2 27 48,4 12,8
Number of participations in in-service training on subjects related to physics teaching	None 1-2 3-5 6 and more	88 129 109 21	25,4 37,2 31,4 6
Total		374	100

*Two of teachers answered this item as "I don't remember"

The majority of physics teachers who responded to the questionnaire were male. Only 8.6 percent of participants are managers. The participating teachers work at least one Anatolian high school, at least one sports high school, and at least one social sciences high school. Those with a total teaching career of 21 years or more had the greatest involvement rate, while those with 16-20 years of service had the lowest. The school or program from which survey participants got their teacher education had the greatest rate and the lowest rate (education institution). It was shown that individuals who attended in-service training on teaching-related topics between three and five times had the greatest rate, while those who did not go at all had the lowest rate. The proportion of teachers who attended in-service training on physics teaching topics once or twice was greatest, while those who went six times or more was lowest.

Data Collection and Analysis

The data for this research were gathered using a questionnaire. At the stage of developing the questionnaire questions, semi-structured interviews on the topic were performed in conjunction with a literature review. Eighteen physics teachers employed by the Ministry of National Education in Giresun were interviewed. When selecting the teachers whose views would be considered, consideration was given to the fact that they worked in a variety of various kinds of schools and had varying years of service. Content analysis was performed on the interview data. An item pool was developed based on the data gathered via the interpretation of the analysis's results and a review of the subject's literature. The draft version of the In-Service Training Needs Determination Questionnaire for Physics Teachers was created by identifying the relevant questionnaire items.

To verify the questionnaire's content validity, three faculty members who are specialists in education/educational sciences were contacted. Corrective action was taken in accordance with these views in the draft form. The application was reviewed by a faculty member who is a specialist in Turkish Language and Literature. The form, which was determined to be acceptable in terms of the Turkish language, was submitted to three specialist teachers employed by the Ministry of National Education for their input. Teachers provided good comments on the intelligibility of the phrases used in the questionnaire questions, as well as the questionnaire's structure and substance.

To verify the questionnaire's validity and reliability when used with observational data and to finish the questionnaire, a pre-pilot with seventeen physics teachers employed by the Ministry of Education was performed. At this point, the teacher group for whom the pre-pilot application was created was structured in such a manner that at least one member had each of the demographic criteria provided in the survey, while also taking into consideration the characteristics of the research's target audience. Teachers' opinions toward certain topics and their explanations on the issue were evaluated in the pre-pilot application through questionnaire responses. The survey instructions and survey questions were found to be understandable by the teachers.

The completed In-Service Training Needs Determination Questionnaire for Physics Teachers has four sections: demographic information, general views on in-service training, 33 Likert-type questions, and comments on the program and in-service training. The first section includes eight questions that inquire about the teachers who completed the questionnaire's demographic information. The second section includes eleven closed-ended topics that raise concerns about in-service training. The third section is divided into two sections. The first section includes twenty-one questions that assess teaching profession knowledge, while the second section contains thirty-three items that assess physics teaching. Both sections of the third section were constructed using a five-point Likert scale (I strongly disagree, I disagree, I partially agree, I agree, I strongly agree). The questionnaire's Cronbach Alpha reliability coefficient was determined to be 0.943. One might argue that the questionnaire is very trustworthy.

The questionnaire was sent electronically to the teachers who comprised the survey research sample. Three hundred and seventy-seven physics teachers responded to the questionnaire. Three questionnaires were determined to be invalid during the questionnaire evaluation process, and these questionnaires were excluded from the study. The remaining 347 questionnaires were examined after the three surveys submitted by these teachers were removed. The questionnaire responses were statistically analysed using the SPSS software. The data derived from the 374 examined surveys are presented in the tables in the form of frequencies and percentages.

Findings

According to survey findings, half of teachers desired that in-service training be coordinated centrally by the Ministry of National Education. Some teachers have expressed a desire for the university to organize the training as well. It was found that the majority of teachers want face-to-face in-service training during seminar times. Half of the teachers desired a one-week training session, and almost half desired between one and three days. It was found that teachers will consider it acceptable to conduct the trainings in in-service training centers or schools. It was discovered that half of the teachers want university faculty to provide in-service training, while others desired formatter faculty to conduct the training. 47% of participants responded 'yes' when asked if the activities that allowed active involvement were included in previous in-service training sessions. 72.2 percent of participants responded 'yes' to the question 'Did you find the activities useful?' and 27.8 percent responded 'somewhat'. Table 3 summarizes the participants' overall perceptions of in-service training.

Table 3 General Thoughts of Teachers on in-Service Training

Questions	Answer	f	%
Do you consider in-service training necessary?	Yes Partially No	254 107 13	67,9 28,6 3,5
If you have attended in-service training before, were you satisfied with these trainings?	Yes Partially No	154 183 37	41,2 48,9 9,9
Should training be organized centrally or locally?	Central Local Does not matter	187 122 65	50 32,6 17,4
Which unit should organize the training?	Universities Ministry of Education Private or non-governmental organization Other	135 192 17 30	36,1 51,3 4,6 8
How should education be given?	Face to face Online Mixed	277 8 75	77,8 2,1 20,1
When should in-service training be done?	During seminar periods Weekend During the summer vacation After class on weekdays Other	278 20 55 14 7	74,3 5,3 14,7 3,8 1,9
How long should the training activity last?	1-3 day(s) 1 Week 1 Month Other	164 187 10 13	43,8 50 2,7 3,5
Where should in-service training be given?	In-service training centers In schools Other	175 171 28	46,8 45,8 7,4
By whom should the training be given?	Lecturer Formative teacher Inspector Relevant branch manager Other	196 110 10 15 43	52,4 29,4 2,7 4 11,5
If you have participated before, were there activities that enabled active participation in the in-service trainings you attended?	Yes No I did not participate	176* 145 53	47 38,8 14,2
Total		374	100
If your answer to question 10 is 'yes', did you find these activities useful?	Yes Partially No	127 49 0	72,2 27,8 0
Total		176*	100

Table 4 summarizes the participants' knowledge requirements for the teaching profession. According to Table 4, the areas in which teachers most require assistance include the implementation of innovative programs such as investigative-inquiry teaching, constructivist teaching, workshop, and argumentation. presenting cutting-edge instructional approaches and techniques. Many of our teachers are encouraged to include instructional activities such as individual and group learning, as well as training on the use of new educational technology they seem to be in desperate need of it. Additionally, training to guide students according to their interests and skills, training to identify students' individual characteristics and to establish level groups in the classroom that many of our teachers need in-service training in their areas.

Teachers need less in-service training in areas such as classroom communication and engagement, classroom management models, classroom time management, and problem-solving methods. However, it is recognized that only a small percentage of teachers require in-service training on pre-lesson preparation, information about the work required by the curriculum during the course, information about what to do at the course's conclusion, measurement techniques and tools for evaluating the teaching process, and scientific literacy.

Table 4 Needs for Teaching Profession Knowledge

Needs		Degree of Need					
		(1)	(2)	(3)	(4)	(5)	I
I need the introduction of changing programs (research-inquiry teaching, constructivist teaching, etc.).	f %	18 4,8	62 16,6	113 30,2	92 24,6	89 23,8	0
I need the introduction of contemporary teaching methods and techniques (workshop, argumentation, etc.).	f %	17 4,6	55 14,8	92 24,7	112 30,1	96 25,8	2
I need the introduction of teaching activities (individual learning activities, group learning activities).	f %	24 6,5	77 20,7	100 26,9	92 24,7	79 21,2	2
I need training to determine the individual differences of students and to create level groups in the classroom.	f %	31 8,4	99 26,7	103 27,8	83 22,4	55 14,8	3
I need training in the use of new educational technologies.	f %	30 8,1	69 18,5	96 25,8	97 26,1	80 21,5	2
I need training in the selection and use of tools and equipment to be used in teaching.	f %	38 10,2	81 21,8	98 26,4	85 22,9	69 18,6	3
I need training to guide students according to their interests and abilities.	f %	27 7,3	90 24,3	110 29,7	88 23,8	55 14,9	4
I need training in classroom communication and interaction.	f %	77 20,8	118 31,8	82 22,1	52 14	42 11,3	3
I need training on classroom management models.	f %	74 19,9	127 34,2	79 21,3	54 14,6	37 10	3
I need training on time management in the classroom.	f %	110 29,6	136 36,6	55 14,8	44 11,8	27 7,3	2
I need training in problem solving strategies.	f %	87 23,5	135 36,4	66 17,8	59 15,9	24 6,5	3
I need to be informed about pre-lesson preparation (how to start the lesson, the necessity of the program, analysis of preliminary information, etc.).	f %	141 38	123 33,2	54 14,6	33 8,9	20 5,4	3
During the course, I need information about the studies required by the curriculum.	f %	96 25,8	128 34,4	76 20,4	52 14	20 5,4	2

I need information about what to do at the end of the course (summarizing the course, evaluation, university preparation studies, etc.).	f %	130 35	122 32,8	67 18	30 8,1	23 6,2	2
I need training on assessment techniques and tools based on evaluating the teaching process.	f %	80 21,7	127 34,4	78 21,1	59 16	24 6,5	5
I need training in the use of performance studies and projects in the assessment of cognitive, affective and psychomotor skills.	f %	59 15,9	106 28,6	107 28,8	69 18,6	30 8,1	3
I need training in scientific literacy.	f %	79 21,4	95 25,7	104 28,2	63 17,1	28 7,6	5
I need training in equipping students with cognitive skills such as critical and creative thinking.	f %	61 16,5	91 24,6	110 29,7	71 19,2	37 10	4
I need training on providing students with social skills such as entrepreneurship, communication and empathy.	f %	69 18,6	100 27	104 28	64 17,3	34 9,2	3
I need training on gaining personal competence and skills such as self-confidence, determination and leadership to students.	f %	62 16,7	99 26,7	108 29,1	64 17,3	38 10,2	3
I need training in equipping students with self-discipline and independent study skills.	f %	63 16,9	99 26,6	109 29,3	62 16,7	39 10,5	2

(1): I never agree; (2): I do not agree; (3): I partially agree; (4): I agree; (5): Absolutely I agree; I: Empty / Invalid

Table 5 summarizes the participants' requirements for teaching physics. It is recognized that teachers need in-service training in modern physics applications in technology, as well as in physics course curricula and applications in developed nations. It is recognized that teachers require less in-service training on strategies, methods, and techniques for teaching physics lessons, on the use of various tools and technology for teaching physics lessons, and on activities that connect the development process of physics science to current practices.

Table 5 Needs for Physics Teaching

Needs		Degree of Need					
		(1)	(2)	(3)	(4)	(5)	I
I know the achievements of the current physics course curriculum.	f %	12 3,2	5 1,3	30 8,1	166 44,6	159 42,7	2
I can apply the teaching activities in the current physics curriculum.	f %	12 3,2	14 3,8	102 27,6	164 44,3	78 21,1	4
I have a good command of the skills in the current physics curriculum.	f %	4 1,1	5 1,4	46 12,5	197 53,5	116 31,5	6
I have a good command of strategies, methods and techniques in teaching physics lessons.	f %	6 1,6	7 1,9	55 14,9	194 52,6	107 29	5
I make use of various tools and technology in teaching physics lessons.	f %	16 4,3	23 6,2	85 23	156 42,3	89 24,1	5

I use appropriate teaching activities so that students can develop positive attitudes towards physics.	f %	5 1,4	8 2,2	93 25,1	172 46,5	92 24,1	4
I organize events to establish connections between the development process of physical science and current practices.	f %	7 1,9	25 6,8	111 30,1	160 43,4	66 17,9	5
I know the developmental stages of the learning of physics lesson concepts.	f %	4 1,1	12 3,2	57 15,4	202 54,6	95 25,7	4
I enable students to pose and solve problems using concepts related to physics.	f %	5 1,4	10 2,7	74 20,1	187 50,7	93 25,2	5
I create an environment where students can structure their own learning in teaching physics lesson concepts.	f %	10 2,7	14 3,8	113 30,5	170 45,9	63 17	4
I have sufficient knowledge about misconceptions about physics course concepts and how to eliminate these misconceptions.	f %	6 1,6	5 1,4	59 16	200 54,1	100 27	4
I do experiments in teaching different subjects.	f %	29 7,9	64 17,3	126 34,1	111 30,1	39 10,6	5
I use simulations in teaching different subjects.	f %	15 4,1	32 8,7	112 30,4	151 40,9	59 16	5
I organize activities that can establish the relationship between physics course itself, other courses, interdisciplinary disciplines and daily life.	f %	7 1,9	37 10,1	121 32,9	158 42,9	45 12,2	6
I create an environment where students can develop positive attitudes on issues related to the teaching of different subjects.	f %	5 1,4	22 6	83 22,4	194 52,4	66 17,8	4
I apply measurement and evaluation methods and techniques in accordance with the physics curriculum.	f %	5 1,4	16 4,3	76 20,5	186 50,3	87 23,5	4
I have sufficient knowledge about project preparation, execution processes and techniques.	f %	21 5,7	49 13,3	105 28,5	144 39	50 13,6	5
I have sufficient knowledge about the applications of modern physics in technology.	f %	15 4,1	17 4,6	108 29,2	168 45,4	62 16,8	4
I know about scientists who contributed to the development of physics.	f %	5 1,4	24 6,5	107 28,9	166 44,9	68 18,4	4
I have knowledge about physics course curricula and applications in developed countries.	f %	49 13,3	66 17,9	135 36,7	87 23,6	31 8,4	6
I need to use additional material in teaching the subject of force-motion.	f %	19 5,1	45 12,2	119 32,2	126 34,1	61 16,5	4
I need to do different activities in the teaching of energy.	f %	16 4,3	52 14,1	102 27,6	133 36	66 17,9	5

I need to use contemporary methods and techniques in teaching the subject of pressure and buoyancy.	f %	17 4,6	41 11,1	107 29	146 39,6	58 15,7	5
I need to do different activities in teaching the subject of heat and temperature.	f %	15 4,1	44 12	115 31,3	139 37,9	54 14,7	7
I need to use contemporary methods and techniques in teaching the subject of electricity.	f %	14 3,8	41 11,1	113 30,6	130 35,2	71 19,2	5
I need to use additional materials in the teaching of magnetism.	f %	16 4,3	39 10,5	99 26,8	141 38,1	75 20,3	4
I need to use contemporary methods and techniques in teaching the subject of simple harmonic motion.	f %	21 5,7	45 12,2	105 28,5	135 36,6	63 17,1	5
I need to do different activities in teaching waves and wave mechanics.	f %	18 4,9	36 9,8	91 24,7	145 39,3	79 21,4	5
I need to use additional material in the teaching of optics.	f %	18 4,9	36 9,7	78 21,1	155 41,9	83 22,4	4
I need to use contemporary methods and techniques in the teaching of modern physics.	f %	18 4,9	35 9,5	103 28,1	137 37,3	74 20,2	7
I need to use additional material in teaching the subject of atomic physics.	f %	13 3,5	41 11,2	101 27,5	130 35,4	82 22,3	7
I need to use contemporary methods and techniques in teaching the subject of radioactivity.	f %	18 4,9	38 10,3	99 26,9	134 36,4	79 21,5	6
I need to use contemporary methods and techniques in teaching the application of modern physics in technology.	f %	19 5,2	34 9,3	92 25,1	143 39	79 21,5	7

(1): I never agree; (2): I do not agree; (3): I partially agree; (4): I agree; (5): Absolutely I agree; I: Empty / Invalid

According to Table 5, it has been determined that only a small percentage of teachers require in-service training on misconceptions about physics lesson concepts and how to eliminate them, the developmental stages of learning physics lesson concepts, and the use of appropriate teaching activities to help students develop positive attitudes toward physics. The objectives of the present physics curriculum, the teaching activities included in the current physics curriculum, and the abilities included in the current physics curriculum are also seen as areas in which relatively few of teachers need in-service training.

Teachers need less in-service training in posing and solving problems using physics ideas, fostering an atmosphere in which students may organize their own learning when teaching physics lesson concepts, performing experiments, and utilizing simulations when teaching various topics. On the other hand, it is evident that very few of teachers require in-service training about establishing connections between physics lessons, other subjects, interdisciplinary disciplines, and daily life, as well as creating an environment in which students can develop positive attitudes toward teaching various subjects and scientists who contribute to the development of physics. Again, it is recognized that relatively few of teachers need in-service training in the use of measurement, assessment, and project planning and execution approaches appropriate for the physics curriculum.

Discussion and Conclusion

The purpose of this research is to ascertain the in-service training requirements for physics teachers. According to survey findings, it may be said that physics teachers get little in-service training on physics teaching-related topics. The research assessing the Ministry of National Education's IST initiatives indicates, the IST requirements of teachers were not being addressed sufficiently (EARGED, 2006). It is revealed that the majority of physics teachers who responded to the survey believed in-service trainings were essential. Another research of physics teachers showed that they attended relatively few in-service courses, despite the fact that the majority of teachers believed IST was essential (Gönen & Kocakaya, 2006). In the present study given that the majority of participants had more than ten years of experience, one might argue that the amount of in-service training obtained by physics teachers is not sufficient.

In the literature stated that the IST activities planned for physics teachers were insufficient in terms of quantity and quality, and the teachers who participated did not deem the practices beneficial (Gönen & Kocakaya, 2006; Kaya, 2003). Bayar and Kösterelioğlu (2014) found that teachers' satisfaction with the IST practices in which they engage is very poor, and as a consequence, teachers are unwilling to participate in IST activities. Despite that it is reveal that the majority of physics teachers who responded to the survey were pleased with previous in-service trainings. Almost half of the teachers reported having previously attended in-service trainings that included exercises that required active involvement. It is assumed that the majority of teachers find active learning activities beneficial. It is believed that the previous IST experience may have a role in the teachers opinions.

When designing IST programs should be considered the wishes and expectations of teachers about time and location. The majority of teachers surveyed desire to take in-service training face-to-face. The findings of the study by Parmaksız and Sıcak (2018) is similar to this study. According to Parmaksız and Sıcak (2018), teachers stated that face-to-face IST is more effective than online IST. Ozer (2004) suggest that the teachers may spend certain working hours in a week on in-service training instead of teaching students. However, the majority of teachers surveyed desire to take in-service training during seminar periods. Half of teachers desired a one-week training session, while almost half desired between one and three days. In-service training centers and schools have stand out the location where in-service training will be given. It reveals that half of the teachers want university lecturer to provide in-service training, while others desired formatter teachers to do the training.

In the literature stated that that some teachers may resist applying new curriculums (Ersoy et al., 2018; Erdoğan et al., 2015). Ersoy et al. (2018) stated that this problem can be overcome according to the teachers better know and understand the new curriculum. According to the survey findings, teachers most need to be introduced to innovative programs such as inquiry-based and constructivist education.

Classrooms using interactive participation have significantly higher learning outcomes than classrooms using traditional lectures (Von Korff et al., 2016). In the literature stated that physics teachers do not abandon traditional teaching methods. However, it is stated that teachers do not use methods and techniques suitable for the curriculum (Kapucu, 2010; Ayvacı & Bebek, 2018; Frågåt et al., 2021). Survey findings confirms previous studies, teachers most need to be introduced to current teaching methods and techniques such as workshop and argumentation.

Since 2011, MoNE has determined the in-service education needs online using questionnaires for teachers. According to the questionnaire results in 2012, teachers indicated need for teaching technologies and material development (Yolcu &, Kartal, 2017). In the present study recognized that the majority of teachers need in-service training on teaching technologies, tools, and materials suitable for physics instruction, as well as their usage. In this respect, it may be said that the lack of in-service training on teaching technologies and material usage. However, it is recognized that teachers need the introduction of instructional activities such as individual and group learning. It is recognized that many of teachers require in-service training in educational fields such as identifying students' individual differences and establishing level groups in the classroom, and training in guiding students based on their interests and abilities.

According to the study that physics teachers to describe the knowledge and skills needed to be a good science/physics teacher, the in-service teachers put most emphasis on content knowledge (Frågåt et al., 2021). It has been determined that teachers need in-service training in utilizing current methods and approaches in teaching modern physics, in using extra resources in teaching atomic physics, in teaching radioactivity, and in teaching the application of modern physics in technology. Additionally, teachers need in-service training on the use of extra resources in the teaching of optics, magnetism, and force and motion. It is recognized that teachers need on-the-job training to conduct various activities related to the teaching of energy, heat, temperature, waves, and wave mechanics. It is recognized that teachers need on-the-job training in the use of contemporary methods and techniques for teaching pressure and buoyancy, electricity, and basic harmonic motion.

Physics contains thinking and formulating higher mental processes. Physics learning must develop student's competence in terms of cognitive, affective, and psychomotor areas (Suhendi et al.,2018). According to survey findings, it is recognized that teachers need in-service training in the use of performance studies and projects to assess cognitive, affective, and psychomotor abilities, as well as to develop cognitive skills such as critical and creative thinking in students. In addition, teachers require in-service training in order to educate pupils social skills such as entrepreneurship, communication, and empathy. Additionally, it is recognized that teachers need ongoing professional development in order to provide students with personal competence and abilities such as self-confidence, drive, and leadership, as well as self-discipline and autonomous work skills.

It has been determined that nearly half of participant teachers needed in-service training on measuring and evaluating of the teaching process. In the literature stated that teachers do not have sufficient knowledge about alternative measurement techniques. There are many studies stressing that teachers use alternative measurement techniques less than traditional measurement techniques (Bayat & Şentürk, 2015).

According to survey findings, one might argue that teachers do not need in-service training in some topics. These topics are strategies, methods, and techniques for teaching physics lessons, activities for establishing connections between the development process of physics and current practices, developmental stages associated with the learning of physics lesson concepts, and the use of appropriate teaching activities for student engagement.

It has been determined that the majority of participating teachers need in-service training in innovative methods to learning, such as inquiry-based and constructivist teaching. However, it is evident that the majority of teachers do not need in-service training in order to prepare and execute a physics session. The teachers meet a novel approach to lesson preparation and implementation during their in-service training is questionable.

Suggestions

The suggestions to make the in-service training activity for physics teachers desirable and reach the determined targets can be summarized as follows;

- Increasing the number of in-service trainings for physics education
- Making face-to-face in IST centers or schools
- Making during seminar periods and in a period not exceeding one week
- Management the process by specialists
- The suggestions for developing the contents of the in-service training;
- The introduction of changing curriculum
- Making trainings to enabled teachers' active participation
- Introducing current teaching methods and techniques such as workshop and argumentation
- The subject of using of new instructional technology
- The subject of organizing individual and group learning activities
- The subject of attracting the interest of students who are not interested in physics
- The subject of using of performance and projects
- The subject of measuring and evaluating of the teaching process
- The subject of equipping cognitive skills such as critical and creative thinking in students

- The subject of identifying students' individual differences and, guiding students based on their interests and abilities
- The subject of equipping entrepreneurship, communication, empathy, self-confidence, drive, leadership, self-discipline and autonomous work skills in students

The findings of this research and the recommendations made will assist educators and administrators in planning and organizing IST activities, and it is hoped that they will shed light on the studies they will conduct in the context of eliminating deficiencies and improving IST activities for academicians working in the field of education.

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