www.ijemst.net

The Readiness of Stakeholders in the Scientific Inquiry-Supported Mentoring Project

Ayse Oguz Unver
Mugla Sitki Kocman University, Turkey

Hasan Zuhtu Okulu
Mugla Sitki Kocman University, Turkey

Nilay Muslu
Mugla Sitki Kocman University, Turkey

Sertac Arabacioglu
Mugla Sitki Kocman University, Turkey

Yasemin Ozdem Yilmaz
Mugla Sitki Kocman University, Turkey

Burcu Senler
Mugla Sitki Kocman University, Turkey

Onur Bektas
Mugla Sitki Kocman University, Turkey

To cite this article:

Oguz Unver, A., Okulu, H. Z., Muslu, N., Ozdem Yilmaz, Y., Senler, B., Arabacioglu, S., & Bektas, O. (2023). The readiness of stakeholders in the scientific inquiry-supported mentoring project. *International Journal of Education in Mathematics, Science, and Technology (IJEMST), 11*(1), 37-55. https://doi.org/10.46328/ijemst.2651

International Journal of Education in Mathematics, Science and Technology

2023, Vol. 11, No. 1, 37-55 https://doi.org/10.46328/ijemst.2651

The Readiness of Stakeholders in the Scientific Inquiry-Supported Mentoring Project

Ayse Oguz Unver, Hasan Zuhtu Okulu, Nilay Muslu, Yasemin Ozdem Yilmaz, Burcu Senler, Sertac Arabacioglu, Onur Bektas

Article Info

Article History

Received:
07 November 2021
Accepted:
25 August 2022

Keywords

Teacher professional development
Readiness in education
Scientific inquiry
Mentoring

Abstract

The effectiveness of professional development programs for teachers in Turkey is limited because the programs are not designed to meet individual teacher needs. Although teachers are implementers who perform classroom practices, they are in the role of students in these programs. The project supported by The Scientific and Technological Research Institution of Turkey (TUBITAK) 1001-Grant 220K080 entitled "Designing and Evaluation of the Effectiveness of Scientific Inquiry Supported by Online Mentoring (e-scaffolding) in In-service Teacher Training" aims to examine and evaluate a professional development model. The project involves various strategies, such as mentorship, coaching, peer learning, and collaboration, for prioritizing teachers' ideas and expectations. This study intends to reveal the readiness of the stakeholders (participating teachers and mentors) in the online mentoring model supported by scientific inquiry as part of the professional development process of teachers. The prominent results of the research are that teachers have positive opinions about the importance of scientific inquiry-based learning and teaching, teachers' expectations from professional development programs vary by their levels of experience. In conclusion, this study is important in terms of making teachers' voices heard and designing professional development programs in line with their expectations.

Introduction

Almost everyone gets involved in formal education at some point of their lives. It is probably for this reason that individuals, who have their own experiences with formal education, are so liberal with expressing their opinions to teachers about what constitutes quality education while they cannot criticize the work of an architect or an engineer this easily. Teaching is possibly the only profession regarding which all segments of society have distinct ideas. So, what is expected? The first expectation of schools, administrators, and families from teachers is quality education. Accordingly, teachers are expected to (1) be able to adapt to change and the current age, (2) have a high level of communication and interaction with students and students' parents, (3) have an ever-lively appetite for learning, (4) have the ability to show leadership in the classroom, (5) successfully manage stress, (6) be aware of their role model responsibilities, (7) have technology competency, and (8) have received pedagogical formation training, including continuing a regular and gradual process of self-improvement.

The first initiative that can be considered to meet all these expectations is in-service professional development programs. However, the perception of professional development programs needs to change. Each teacher has unique values, beliefs, thoughts, and feelings of their own. Therefore, each teacher has different expectations and requirements in the classroom environment. Professional development programs should be designed in a more solidary, aware, courageous, empathetic, and collaborative manner by considering what makes teachers unique, consistent with their opinions, dreams, future plans, and expectations. Further, professional development programs should no longer be compulsory; these programs should be transformed into settings of dialogue that aim to understand teachers and touch their lives.

The Role of In-Service Training Programs in Teachers' Professional Development and Their Limitations

The Ministry of National Education of Turkey (MoNE) defines professional development programs as "all conscious and planned efforts and natural learning experiences that aim to directly or indirectly benefit the individual, group, and school and contribute to the quality of education" (Ministry of National Education, 2017). Meanwhile, the Organisation for Economic Co-operation and Development (OECD) defines professional development as "activities that develop an individual's skills, knowledge, expertise, and other characteristics as a teacher" (OECD, 2009). Both definitions are quite comprehensive and include numerous learning opportunities for teachers. Taitelbaum et al. (2008) suggested that teachers need to be involved in a process of professional development where they receive continuous guidance and support. The STeLLA program of the National Science Foundation in the United States is an example of continuous a professional development program (BSCS Science Learning, 2021). Similarly, in Europe, teachers' continuous professional development is encouraged through Amgen Teach programs offered in Vienna and Graz by Open Labs (Bertsch, 2017).

In Turkey, in-service professional development programs are centrally planned and teachers' participation is generally compulsory. These training programs are provided by the Ministry of National Education, for a duration varying from one day to one week, depending on the subject. Examining teachers' participation in professional development programs reveals that they primarily participate in courses, workshops, conferences, and seminars (OECD, 2009). Recently, in workshops and seminars, practices have been interactively presented and learning materials have been used. The OECD (2009) Teaching and Learning International Survey grouped teachers' professional development activities into seven categories: courses/workshops (e.g., on a subject matter or methods and/or other education-related topics), education conferences or seminars (where teachers and/or researchers present their research results and discuss education problems), qualification programs (e.g., a degree program), observation visits to other schools, participation in a network of teachers formed specifically for the professional development of teachers, individual or collaborative research on a topic of professional interest, and mentoring and/or peer observation and coaching as part of a formal school arrangement.

In most professional development courses, workshops, conferences, and seminars, teachers are only presented with practical knowledge. The knowledge conveyed to teachers consists of theories and research results. However, teachers experience significant difficulties in putting into practice the knowledge they acquire from experts outside the classroom (Cochran-Smith & Lytle, 1999). However, in hands-on professional development training programs and workshops, teachers often take on the role of students and learn through activities. This learning takes place outside the classrooms, which are teachers' natural teaching environments. In formulating practical knowledge, teachers use existing theories and research in order to produce knowledge based on classroom practices. A major part of the information obtained through mentoring/guidance and coaching falls under this category. Because of such activities, teachers can improve teaching processes consistent with the needs of their students and themselves (Simon, 2012).

Programs aimed at supporting teachers' professional development are referred to as traditional forms of professional development (Arabacioglu, 2022; Garet et al., 2001; Oguz Unver & Okulu, 2022). According to Hendriks et al. (2010), the low effectiveness of such programs can be ignored because their duration is short and can accommodate a large number of participants in one session. However, research and technical reports emphasize that current professional development programs are far from meeting the needs of teachers and achieving the target learning outcomes (Bayrakçı, 2009; Education Reform Initiative, 2017; Gökmenoğlu & Clark, 2015; Hendriks et al., 2010; Ministry of National Education, 2017). Penuel et al. (2007) indicated that teachers are not sufficiently encouraged to explore new concepts and teaching strategies with such programs. Professional development programs do not consider teachers' experience levels and professional background and overlook their real needs for professional development (Bayrakçı, 2009). Furthermore, ideas acquired in professional development programs are often limited in classroom settings (Gökmenoğlu & Clark, 2015). As per Putnam and Borko (2000), in-service training programs do not address specific situations faced in classrooms or afford teachers the luxury of exploring ideas without having to worry about what they are going to do the next day.

In contrast, there are innovative approaches that aim to take the process of professionally developing teachers to their classrooms. The use of in-service training approaches, such as mentoring/guidance, coaching, peer learning, and cooperative learning, is limited in Turkey, and participation in training programs that utilize such approaches is voluntary (European Commission, 2018). However, there is growing interest in the type of "reform" where professional development take place in teachers' own environment during the process of instruction (Garet et al., 2001). The National Research Council (2012), an institution that has played a great role in shaping the American education system, emphasizes that this type of training is especially necessary for teachers in the field of science education. According to Eurydice Network, an education information network funded by the European Commission, in most European Union countries, professional development programs make use of methods of mentoring, discussion meetings with school administration and colleagues, observation visits to the other teachers' classrooms, and lesson planning and evaluation (OECD, 2009).

This study aims to investigate the readiness of the classroom and science teachers who participated in the project supported by TUBITAK 1001-Grant 220K080 entitled "Designing and Evaluation of the Effectiveness of Scientific Inquiry Supported by Online Mentoring (e-scaffolding) in In-service Teacher Training." To this end, first, this study introduces an online mentoring model supported by scientific inquiry. Second, it presents the demographic characteristics of the teachers and mentors who participated in the project. Third, using the measurement tools developed by the researchers involved in the project, the expectations of the teachers from professional development programs, their views on scientific inquiry in teaching, and their level of readiness to be video recorded during class are investigated. Lastly, validity and reliability tests are conducted to determine the level of agreement between mentors' feedbacks.

Method

This study was conducted as a part of the professional development project. This four-stage scientific inquiry-based project offers a mutual dialogue platform on which the needs and expectations of each and every teacher is addressed independently from one another. In the next section, the project is introduced.

e-Mentoring Supported by Scientific Inquiry

The project makes use of mentoring, coaching, peer learning, cooperation, and collaboration strategies where teachers' opinions and expectations are prioritized. It involves four stages. In the first stage, teachers are asked to share their opinions. In the second stage, they are asked to videotape the activity that they carry out in the classroom and upload this video to the online platform of the project.

The video is evaluated by mentors in line with the scientific inquiry-supported classroom observation protocol developed by the researchers. Then, the researcher shares feedback supported by short clips with the teachers face-to-face or online. Having received feedback, the teacher plans the next activity to be carried out in the classroom and videotape it. Thus, in the third stage, a repeated process of trial and improvement takes place in order to formulate solutions.

Starting from the third and fourth activities, other teachers who take part in the activities can provide peer feedback. In the fourth stage, the final evaluation of the examined activities is conducted. In this study, qualitative and quantitative data collection tools were used for two purposes: to design the program (developing the digital platform, videotaping classroom activities, processing video recordings, and creating activity kits) and to evaluate the program (semi-structured interviews made with teachers, questionnaires and opinion forms, observer evaluation rubrics, activity evaluation forms, and teacher peer evaluation forms). Here, the aim is to establish patterns that enable effective professional development.

Study Group

The study group comprised 20 teachers, of which 10 were classroom teachers and 10 science teachers, and 6 mentors who were experts in the field of science education. The participants were selected through convenience sampling, and data were collected using online forms and—when necessary—face-to-face interviews (Fraenkel & Wallen, 2000).

Data Collection Tools

To determine the readiness of teachers and mentors who participated in the project, measurement tools developed by the researchers were used. The measurement tools used are as follows: a participant information form, used to determine the demographic characteristics of the teachers; teachers' expectations of professional development scale, used to determine teachers' expectations from in-service training programs; comprehensive beliefs about the inquiry and teaching and learning experiences instrument, used to determine participants' opinions on the use of scientific inquiry in education; the classroom video recording readiness scale, used to determine teachers' readiness for video recording during classroom activities; and lastly, the scientific inquiry-supported classroom observation protocol, used to determine the agreement between mentors' feedbacks.

Participant Information Form

The professional development prospects offered by the project brought together stakeholders from different backgrounds and with various characteristics. Two different participant information forms were prepared for the participants of the project, namely, teachers and mentors. The form prepared for teachers provides mentors and other stakeholders with data in three sections. The first section collects descriptive data, such as age, gender, and educational background. The second section collects teachers' opinions on what previous professional development programs in which they participated offered and contributed to. The third section collects data on teachers' daily routines. In contrast, the form prepared for mentors comprises two sections. The first section collects descriptive data, while the second section collects data on mentors' areas of expertise and academic background. To examine the clarity, answerability, relevance, and reliability of the questions in both forms, experts in the relevant areas were consulted. Then, the forms were pilot-tested, and the results were analyzed.

Teachers' Expectations of the Professional Development Form

This form comprises themes identified based on literature reviews and experiences of the researchers and 49 items under these themes developed in line with expert opinions (Muslu et al., 2022). This form has six themes, namely, support, practice, learning, student success, organization, and career. The form was based on a 5-point Likert scale.

The Comprehensive Beliefs about the Inquiry and Teaching and Learning Experiences Instrument

Developed by Abdallah (2003) to determine teachers' beliefs about scientific inquiry and adapted into Turkish by Senler et al. (2022), the "Comprehensive Beliefs about Inquiry and Teaching and Learning Experiences Instrument" was used to determine participants' opinions on the use of scientific inquiry in education. This measurement tool consists of 4 subscales—Teaching and Learning Inquiry for Learning Science, Beliefs about Barriers to Using Inquiry Approaches in Science Classrooms, Beliefs about Student Outcomes Resulting from the Use of Inquiry Approaches in Science Classrooms, and Beliefs about Scientific Inquiry—and 71 items. The Inquiry Teaching and Learning for Learning Science subscale is measured on a 3-point Likert scale (3 =

frequently, 2 = sometimes, and 1 = rarely), while the other subscales are measured on a 5-point Likert scales (5 = strongly agree, 4 = agree, 3 = undecided, 2 = disagree, and 1 = strongly disagree).

Classroom Video Recording Readiness Scale

This scale provides a conceptual framework to determine whether teachers possess the knowledge, skills, and self-efficacy necessary for the use of a camera in the classroom as well as reveals their attitudes toward video recording. The scale comprises 6 subdimensions—preparing the recording environment, attitude toward video recording, familiarity with video recording tools, management and sharing of recordings, coping with recording stress, and video recording competence—and 40 items (Arabacıoğlu et al., 2022).

Scientific Inquiry-Supported Classroom Observation Protocol

Developed to identify teachers' commitment to scientific inquiry, reveal their strengths, and provide evidence on why they need to improve certain competencies, the scientific inquiry-supported classroom observation protocol consists of four sections: descriptive information, course structure, course overview, and teacher–student communication. Primarily focusing on the role of the teacher in scientific inquiry-supported classroom practices, this observation protocol, which is suitable for use in crowded classrooms and nonhomogeneous groups to evaluate all aspects of the use of scientific inquiry, is unique not only in terms of content but also development and implementation, and it can be used by observers and teachers for individual evaluation (Oguz Unver et al., 2022).

Data Analysis

The SPSS 22.0 statistical analysis software was used for the quantitative, descriptive, and deductive analyses of the study data. Qualitative data obtained with open-ended questions were summarized by the researchers in line with the identified themes and analyzed descriptively. The next section provides analyzes the data obtained using the mentioned measurement tools vis-à-vis the relevant literature.

Results and Discussion

In this section, first, the demographic characteristics of the teachers and mentors who participated in the project are provided. Second, teachers' expectations from professional development programs, opinions on scientific inquiry, and readiness to videotape their classroom activities are analyzed. Lastly, the results of the validity and reliability tests regarding the agreement between mentors' feedbacks are presented. The findings are evaluated against the information available in the relevant literature.

Findings Obtained from the Participant Information Form for Teachers

The demographic characteristics of the teachers who participated in the project after being contacted in the spring and fall semesters of the 2021–2022 academic year are presented in Table 1. The project activities were carried out face-to-face or through online interaction with 20 teachers who volunteered to participate in the project.

Table 1. Demographic Characteristics of the Teachers

Demographic Characteristics	Answer	Number	Total Number	%
Gender	Female	17	20	85
	Male	3	20	15
Specialty	Science teacher	10	20	50
	Classroom teacher	10	20	50
Years of professional experience	6–10 years	2	20	10
	11–15 years	4	20	20
	15 years and over	14	20	70
Type of school	Public primary and secondary school	15	20	75
	Science and arts centers (BILSEM)	5	20	25
Educational background	Bachelor’s degree	12	20	60
	Master’s student	3	20	15
	Master’s degree	5	20	25
Grade level taught	1st grade	3	20	15
	2nd grade	1	20	5
	3rd grade	3	20	15
	4th grade	2	20	10
	5th grade	6	20	30
	6th grade	4	20	20
	7th grade	1	20	5

Analysis of the data obtained from this form revealed that the study group consisted of teachers who were quite different from each other in terms of experiences, needs, and expectations. The teachers who took part in the project had also participated in other professional development courses/seminars as well. The teachers were found to have mostly preferred professional development programs that focused on pedagogical competencies, as well as knowledge, and methods in their respective fields (science/classroom teacher). Most training programs in which teachers had participated were shorter than one week. Thus, it can be said that the teachers who participated in the project did not take part in any long-term professional development program.

Findings Obtained from the Participant Information Form for Mentors

The information forms of the six mentors who watched teachers’ videos and provided feedbacks was examined to identify participants’ demographic characteristics and areas of expertise. The findings obtained from the analysis are presented in Table 2.

Table 2. Demographic Characteristics of the Mentors

Demographic Characteristic	Answer	Number
Gender	Female	3
	Male	3
Specialty	Science education	4
	Pre-school education	1
	Classroom education	1
Years of professional experience	≤5	2
	5–10	1
	10–15	2
	15+	1
Experience abroad	Yes	5
	No	1
Previous work experience	Teacher	3
	No	3
Educational background	Ph.D. student	1
	Ph.D.	5

The video recordings submitted by 20 teachers were analyzed by three mentor groups, each comprising two mentors. The study ensured that the mentors of the study group comprising classroom and science teachers were experts (Ph.D. holders or students), who had experience abroad or had engaged in teaching before they started working as a teacher.

Findings Obtained from the Teachers' Expectations of Professional Development Scale

The descriptive analysis of teachers' mean scores for the subdimensions of the Teachers' Expectations of Professional Development Scale is presented in Table 3.

Table 3. Teachers' Subdimension Scores

Subdimensions	N	Minimum	Maximum	Mean	Std. Deviation
Learning	20	2.67	5.00	4.37	.67
Career	20	1.33	5.00	3.54	1.06
Organization	20	3.09	5.00	4.45	.54
Support	20	3.00	5.00	4.32	.67
Practice	20	2.86	5.00	4.28	.69
Student success	20	4.00	5.00	4.68	.42

Table 3 shows that the teachers' subdimensions scores are higher than 3, which is the average score of the subdimensions. While teachers received the highest mean score for the student success subdimension, 4.68 out of 5, they got the lowest mean score for the career subdimension, 3.54 out of 5. The distribution of teachers' subdimension scores by their specialties is presented in Table 4. As is seen in Table 4, classroom teachers' scores for the subdimensions of career, organization, and practice are higher than those of science teachers. In terms of learning, support, and student success, the scores of science teachers are higher than those of classroom teachers.

Table 4. The Distribution of Teachers' Subdimension Scores by Specialty

Subdimensions	Specialty	N	Mean	Std. Deviation	Std. Error Mean
Learning	Science teacher	10	4.46	.68	.22
	Classroom teacher	10	4.29	.69	.22
Career	Science teacher	10	3.53	1.30	.41
	Classroom teacher	10	3.55	.82	.26
Organization	Science teacher	10	4.37	.61	.19
	Classroom teacher	10	4.54	.47	.15
Support	Science teacher	10	4.34	.70	.22
	Classroom teacher	10	4.29	.67	.21
Practice	Science teacher	10	4.26	.70	.22
	Classroom teacher	10	4.30	.71	.22
Student success	Science teacher	10	4.73	.44	.14
	Classroom teacher	10	4.62	.42	.13

To keep up with the ever-evolving profession of teaching, teachers need to develop themselves professionally. To this end, teachers should be provided with professional development opportunities (Bellibaş & Gümüş, 2016). According to Philips (2008), in-service training programs play a critical role in the professional development of teachers. The present study analysis revealed that the scores of the teachers who participated in the project were above average for six subdimensions. This finding points to the fact that teachers are aware of the importance of professional development programs and their expectations from such trainings.

Comparing the subdimension scores of the teachers who participated in the project revealed that they had highest score for the subdimension of student success. This finding is consistent with other studies (Bellibaş & Gümüş, 2016; West 2002) that emphasize that the primary goal of professional development programs is improving student success. Additionally, the descriptive analysis results by year of professional experience indicate that the highest score for each subdimension belongs to different groups of teachers. This finding suggests that the expectations of teachers vary by their levels of professional experience.

Findings Obtained from the Comprehensive Beliefs about Inquiry and Teaching and Learning Experiences Instrument

A descriptive analysis of teachers' scores for the subscales of "Comprehensive Beliefs about Inquiry and Teaching and Learning Experiences Instrument" is presented in Table 5.

Table 5. Teachers' Subscale Scores

	N	Minimum	Maximum	Mean	Std. Deviation
Importance of Inquiry Teaching and Learning for Learning Science	20	41.00	123.00	114.05	13.18
Beliefs about Barriers to Using Inquiry Approaches in Science Classrooms	20	8.00	40.00	28.85	4.18
Beliefs about Student Outcomes Resulting from the Use of Inquiry Approaches in Science Classrooms	20	8.00	40.00	35.40	4.39
Beliefs about Scientific Inquiry	20	14.00	70.00	57.25	7.50

As is seen in Table 5, teachers' scores for the subscales of the instrument are above average. Teachers' highest mean score is for the Importance of Inquiry Teaching and Learning for Learning Science subscale, 114.05 out of 123. Conversely, the lowest mean score is for the Beliefs about Barriers to Using Inquiry Approaches in Science Classrooms subscale, 28.85 out of 40. The distribution of teachers' subscale scores by their specialties is presented in Table 6.

Table 6. Teachers' Scores by Specialty

	Department	N	Mean	Std. Deviation
Importance of Inquiry Teaching and Learning for Learning Science	Elementary science teacher	10	109.60	15.04
	Primary school teacher	10	118.50	9.81
Beliefs about Barriers to Using Inquiry Approaches in Science Classrooms	Elementary science teacher	10	28.50	3.75
	Primary school teacher	10	29.20	4.76
Beliefs about Student Outcomes Resulting from the Use of Inquiry Approaches in Science Classrooms	Elementary science teacher	10	35.80	4.05
	Primary school teacher	10	35.00	4.90
Beliefs about Scientific Inquiry	Elementary science teacher	10	54.60	6.42
	Primary school teacher	10	59.90	7.88

As is seen in Table 6, classroom teachers' scores for all subscales, except for Beliefs about Student Outcomes Resulting from the Use of Inquiry Approaches in Science Classrooms, are higher than those of science teachers. Science teachers' scores for the Beliefs about Student Outcomes Resulting from the Use of Inquiry Approaches in Science Classrooms subscale are 0.80 points higher than those of classroom teachers. The distribution of teachers' scores for each subscale by their levels of professional experience is presented in Table 7.

As shown in Table 7, teachers with 16–20 years of professional experience scored higher than other groups for all subscales except Beliefs about Barriers to Using Inquiry Approaches in Science Classrooms. Analysis results revealed that teachers' scores for the four subscales were above average. This finding points to the opinion of the teachers who participated in the project that scientific inquiry has an important role in science teaching and learning and that there are no obstacles preventing the use of scientific inquiry in the classroom. It also reveals teachers' awareness regarding the contributions of scientific inquiry-based instruction on student achievement and high confidence in this method. The more self-efficacy teachers perceive in implementing scientific inquiry, the more they believe in the effectiveness of this method (Keline et al., 2002). Therefore, it can be said that the teachers who participated in the project showed high self-efficacy in this regard. The descriptive analysis of the scores of the teachers for the subscales in terms of their specialties and levels of professional experience revealed that classroom teachers and the teachers with a tenure of 16–20 years generally scored higher than other groups. These findings are consistent with the literature (Marshall et al., 2009).

Table 7. Teachers' Scores by their Levels of Professional Experience

	Experience	N	Mean	Std. Deviation
Importance of Inquiry Teaching and Learning for Learning Science	≤10 years	2	114.50	14.85
	11–15 years	5	104.40	19.06
	16–20 years	8	121.13	10.05
	21 years	5	112.20	2.95
Beliefs about Barriers to Using Inquiry Approaches in Science Classrooms	≤10 years	2	26.00	.00
	11–15 years	5	30.00	4.06
	16–20 years	8	28.50	5.53
	21 years	5	29.40	2.61
Beliefs about Student Outcomes Resulting from the Use of Inquiry Approaches in Science Classrooms	≤10 years	2	37.50	3.54
	11–15 years	5	35.20	4.38
	16–20 years	8	38.13	3.04
	21 years	5	30.40	2.19
Beliefs about Scientific Inquiry	≤10 years	2	51.00	1.41
	11–15 years	5	54.20	4.66
	16–20 years	8	60.00	9.07
	≥21 years	5	58.40	7.30

Findings Obtained from the Classroom Video Recording Readiness Scale

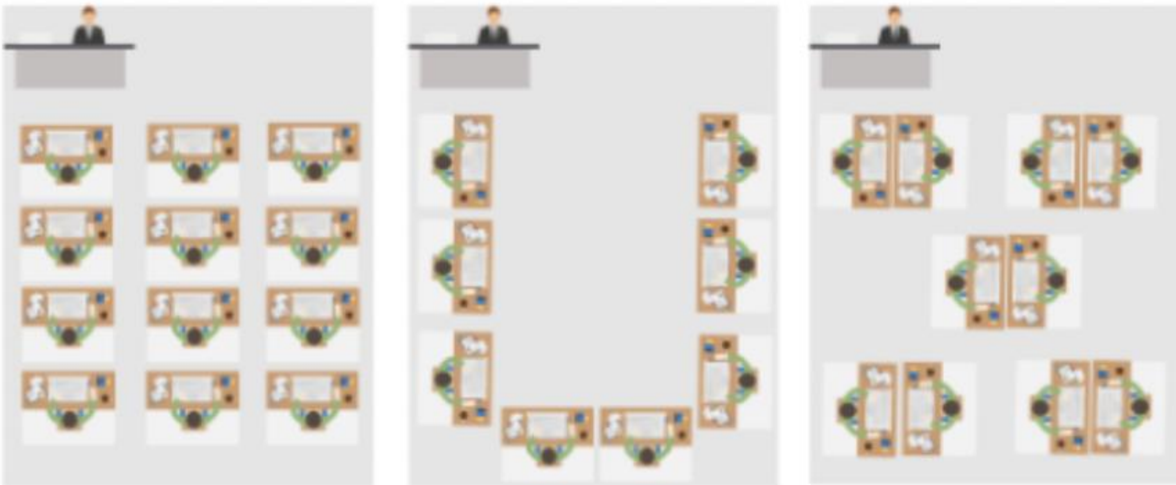
The data obtained from the Readiness for Video Recording in Classroom Scale were analyzed in a descriptive manner. For data interpretation, arithmetic mean, standard deviation, and minimum and maximum values, which are the measures of central tendency and distribution of values, were used. Answers were sought to the question "What are the readiness levels of teachers for video recording in their classrooms?" with a focus on three criteria. In the descriptive analyses of the sample, first, the characteristics and video recording experiences of the sample and the layout of the classrooms where the video was recorded were examined (see Table 8).

In addition to the demographic characteristics of the sample, Table 8 presents information on whether teachers had previously videotaped a classroom activity. It was found that approximately half of the participants (N = 9) had no experience in videotaping a classroom activity and only a small number of participants (N = 3) had recorded classroom activities multiple times. Thus, it was determined that the teachers who stated that they had recorded a classroom activity before did so as a part of a project that required a video recording. Information regarding the classroom layout helps mentors in guiding teachers on issues such as positioning the camera in the classroom and preparing the classrooms for the recording. Among the classrooms where an activity was videotaped, 11 were found to have Layout A, the traditional classroom layout, while 7 had a U-shaped setup. Only two classrooms were observed to have Layout C, which encourages interaction between students.

Table 8. Sample Characteristics

Demographic characteristics	Answer	Number	Total number	%
Previous experience with videotaping a classroom activity	Never	9	20	45
	A couple of times	8	20	40
	Many times	3	20	15
Willingness to videotape a classroom activity	Yes	3	20	15
	No	17	20	85
The layout of the class where the video was recorded*	A	11	20	55
	B	7	20	35
	C	2	20	10

* Represents the layout of the classroom in which teachers who participated in the project videotaped the classroom activity.



A B C

Figure 1 summarizes the aspects in which teachers need to develop themselves to successfully videotape their classroom activities. The analysis of the familiarity with video recording tools subdimension, which includes statements such as "*I am good at using cameras*," "*I am adept at using video recording devices, such as handheld cameras and action cameras*," and "*I can easily solve camera-related technical problems*," revealed that teachers lack competency in this respect. Conversely, some teachers' readiness was low in terms of the dimensions of coping with the stress of recording and preparing the recording environment.

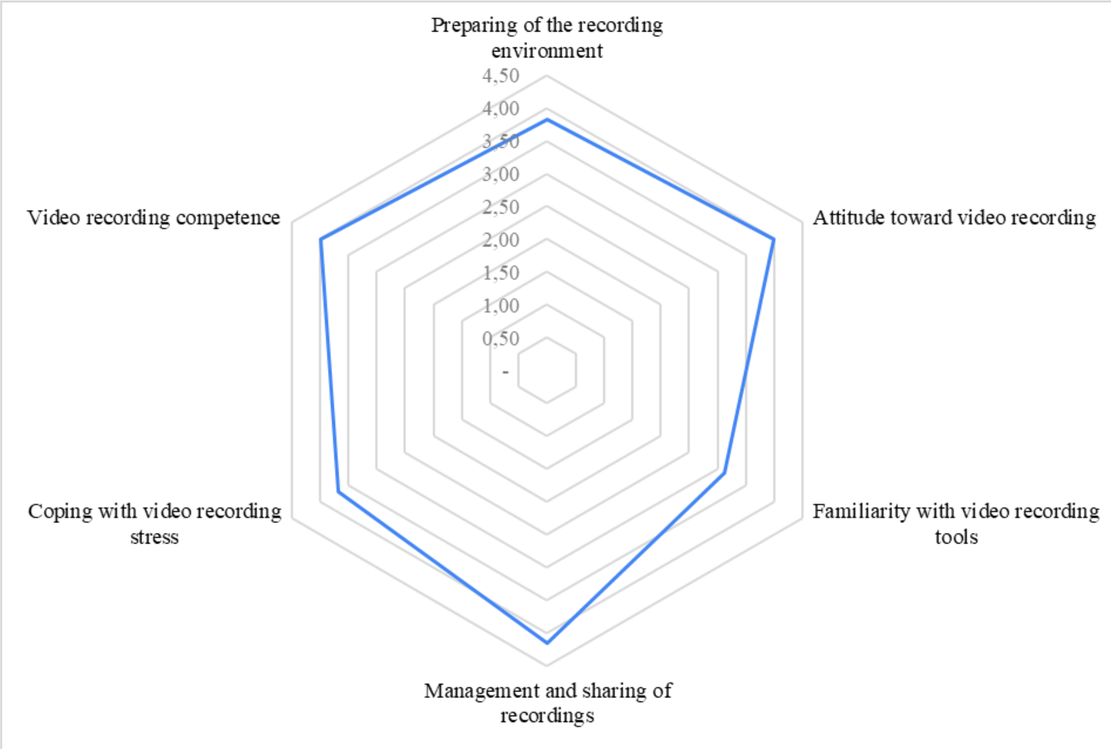


Figure 1. Aspects in which Teachers need to develop themselves to Successfully Videotape their Classroom Activities

Studies have referred to teachers' need for support concerning technical issues, such as owning recording equipment, checking the battery, or mastering the device software (Sherin et al., 2021), to ensure that the content is appropriate and straightforward (Amador et al., 2019). Conversely, research suggests that teachers may have concerns regarding the technical quality of a video and who and what was visible in the video frame, which may affect behavior (Richards et al., 2021). Interestingly, the readiness of science teachers, who are expected to have higher technology proficiency, is lower than that of classroom teachers. This situation is considered to be related to the structure of the measurement tool. The measurement tool examines not only technology competency in only one dimension but also components irrelevant to technical proficiency, such as video recording stress, attitude, and preparation of the recording environment. It is commonly accepted in the literature that recording videos of classroom activities is a complex and challenging task for teachers (Richards et al., 2020). However, taking into account the scores obtained from the previous experience with videotaping a classroom activity scale, having recorded classroom activities before can be suggested to support teacher readiness in this respect.

Findings Obtained from the Scientific Inquiry-Supported Classroom Observation Protocol

Investigation of teachers' classroom practices comprises four stages; in the first stage, teachers video record their classes; in the second stage, teachers upload the videos to the project's online platform; in the third stage, mentors analyze these videos by using the observation protocol; and in the fourth stage, personalized feedback based on the individual needs of the teacher is provided. For the analysis of teachers' videos, a total of three mentor groups comprising two field experts were formed. Each mentor group analyzed the lecture videos of seven different teachers. The process of analysis included two mentors watching the video separately, comparing the observation protocol scores with a focus on teacher behavior together, and formulating their feedback in line with the subthemes of the observation protocol. For this process to be effective, there needs to be an agreement between the observation protocol scores of the mentors. Miles and Huberman (1994) suggested using the formula "Inter-rater reliability = [Number of agreements / (Number of agreements + Number of disagreements)] × 100" to calculate inter-rater reliability. Accordingly, the inter-rater reliability coefficients of the observation protocol themes and subthemes identified by mentors by examining the videos were calculated (see Table 9).

Table 9. Inter-rater Reliability Coefficients of the Observation Protocol Themes and Subthemes Identified by Mentors as a Result of the Examination of the Videos Recorded by Teachers in the First Stage

Mentor Groups	Participant	Classroom Environment (IIA)	Supporting Investigation (IIB)	Classroom Communication (IIC)	Lesson Structure (II)	Lesson Overview (III)	Teacher–Student Communication (IV)	Observation Protocol	Arithmetic Mean*
M1–M2	P13	100.00	100.00	100.00	100.00	100.00	100.00	100.00	**96.67**
	P17	100.00	100.00	63.64	88.89	87.50	100.00	88.89	
	P16	88.89	100.00	100.00	97.22	100.00	100.00	97.78	
	P11	100.00	100.00	100.00	100.00	100.00	100.00	100.00	
	P14	100.00	100.00	90.91	97.22	100.00	100.00	97.78	
	P15	88.89	100.00	100.00	97.22	87.50	100.00	95.56	
	P12**	-	-	-	-	-	-	-	
M3–M4	P7	88.89	100.00	90.91	94.44	100.00	100.00	95.56	**96.51**
	P4	88.89	100.00	100.00	97.22	100.00	100.00	97.78	
	P6	100.00	100.00	90.91	97.22	100.00	100.00	97.78	
	P5	88.89	100.00	90.91	94.44	100.00	100.00	95.56	
	P3	100.00	87.50	90.91	91.67	100.00	100.00	93.33	
	P1	100.00	100.00	100.00	100.00	87.50	100.00	97.78	
	P2	100.00	100.00	90.91	97.22	100.00	100.00	97.78	
M5–M6	P8	88.89	81.25	81.82	83.33	87.50	100.00	84.44	**83.81**
	P18	88.89	100.00	63.64	86.11	87.50	0.00	84.44	
	P9	100.00	100.00	100.00	100.00	100.00	100.00	100.00	
	P20	77.78	81.25	90.91	83.33	100.00	100.00	86.67	
	P10	77.78	93.75	100.00	91.67	100.00	100.00	93.33	
	P19	33.33	100.00	45.45	66.67	62.50	0.00	64.44	

M: Mentor code; P: Participant ID

* This value was obtained by dividing the number of examined lecture videos by the sum of the reliability coefficients obtained from the overall observation protocol score.

**The observation protocol was not used because the relevant course duration and content (language education) did not meet the qualifications of scientific inquiry.

According to Table 9, the arithmetic mean values of the inter-rater reliability coefficients of the observation protocol themes and subthemes identified as a result of the examination of the videos recorded by teachers in the first stage by mentor groups (M1–M2, M3–M4, and M5–M6) are 96.67, 96.51, and 83.81, respectively. The fact that these values are greater than 70 for each mentor group indicates that the observations are reliable (Miles & Huberman, 1994).

Conclusion and Recommendations

In this study, the readiness of teachers and mentors who participated in an online mentoring project developed to introduce a new method of professional development was investigated on the basis of different variables (demographic characteristics of the teachers and mentors, teachers' expectations from professional development programs, opinions on scientific inquiry in education, readiness for video recording lectures, and the level of agreement between mentors' feedbacks).

The current curriculum in Turkey is based on research and inquiry (MoNE, 2018). Identifying the needs of teachers, as the implementers of their respective curricula, will help determine their levels of success in field applications. Considering that their tasks involve designing and developing (Dori & Herscovitz, 2005), it can be held that teachers design their classes similar to an architect designing a building. In professional development programs, success is dependent on whether these programs are compatible with areas that teachers need to develop and the curricula that they teach (Capps et al., 2012).

Under the guidance of a qualified mentor, teachers can find answers to the questions they have in mind. Besides pedagogical content knowledge, the teacher must also possess propositional knowledge. Propositional knowledge should be reinforced with procedural knowledge, which is an important tool in the transfer of this type of knowledge. In other words, teachers must adopt multiple new roles, such as motivator, diagnostician, guide, innovator, experimenter, researcher, modeler, mentor, collaborator, and student (Crawford, 2000).

This study demonstrated that teachers have positive opinions about the importance of scientific inquiry-based learning and teaching. Accordingly, it can be said that all teachers will appreciate this professional development program, which aims to improve their teaching through scientific inquiry practices in the classroom. The beliefs of teachers from different specialties and with different levels of experience about scientific inquiry are similar. This finding implies that teachers benefit from a scientific inquiry-based professional development program, regardless of their level of experience or the grade level they teach.

The study findings show that the primary expectation of teachers from professional development programs is that they should contribute to student achievement. Additionally, it was observed that teachers' expectations from professional development programs vary by their levels of experience. This study is important in terms of making teachers' voices heard and designing professional development programs in line with their expectations.

Because this study is a preliminary step in an educational design research and because similar detailed studies will be conducted with a limited number of teachers in the future, its sample size is relatively small for quantitative research, generalization, and interpretive analysis; moreover, the distribution of teachers by work experience is not homogeneous. Therefore, it is recommended that future research is conducted with a larger sample and that it should investigate whether teachers' beliefs about inquiry scores are generalizable. Furthermore, whether the scores differ significantly in larger samples can be investigated through interpretive analyses.

Additionally, in-depth follow-up studies can be conducted on the findings of this study to further explicate its findings. For example, qualitative data may reveal differences, if any, between teachers' perceptions of scientific inquiry and the scientific inquiry practices they utilize in their classrooms. In conclusion, this study contributes to the literature by defining teacher readiness for professional development programs more broadly.

Acknowledgements

This study is based on work supported by the Scientific and Technological Research Council of Turkey, 1001-Scientific Technological Research Project Support Program under Grant 220K080 entitled "Designing and Evaluation of the Effectiveness of Scientific Inquiry Supported by Online Mentoring (e-scaffolding) in In-service Teacher Training" and presented at the International Conference on Education in Mathematics, Science, and Technology (ICEMST 2022), March 24–27, 2022, Antalya, Turkey.

References

Abdallah, I. I. (2003). *Design and initial validation of an instrument for measuring teacher beliefs and experiences related to inquiry teaching and learning and scientific inquiry* [Unpublished doctoral thesis]. The Ohio State University.

Amador, J. M., Keehr, J., Wallin, A., & Chilton, C. (2020). Video complexity: Describing videos used for teacher learning. *Eurasia Journal of Mathematics, Science and Technology Education*, *16*(4). https://doi.org/10.29333/ejmste/113288

Arabacioglu, S. (2022). Can Nanotechnology Keep Us Dry in the Rain: An Inquiry-Based Activity to Help Students Improve Their Investigation Skills. *International Journal of Technology in Education and Science (IJTES)*, *6*(3), 410-426. https://doi.org/10.46328/ijtes.395

Arabacioglu, S., Oguz Unver, A., Senler, B., Okulu, H. Z., Ozdem Yilmaz, Y., & Muslu, N. (2022). Development of classroom video recording readiness scale: A validity and reliability study. *Educational Technology, Theory and Practice*, *12*(2), 328-350. https://doi.org/10.17943/etku.1013535

Bayrakçı, M. (2009). In-service teacher training in Japan and Turkey : A Comparative analysis of ınstitutions and practices. *Australian Journal of Teacher Education*, *34*(1), 10-22.

Bellibas, M. S., & Gumus, E. (2016). Teachers' perceptions of the quantity and quality of professional development activities in Turkey. *Cogent Education*, *3*(1), 1172950, https://doi.org/10.1080/2331186X.2016.1172950

Bertsch, C. (2017). In-service professional development in inquiry based science education-outcomes and challenges, ESERA 2017 Conference, 21-25 August, Dublin.

BSCS Science Learning. (2021). Science Teachers Learning from Lesson Analysis (STeLLA). https://ies.ed.gov/ncee/wwc/Docs/InterventionReports/wwc_PS_STeLLA_IR_may2021.pdf

Capps, D., Crawford, B., & Constas, M. (2012). A review of empirical literature on inquiry professional development: Alignment with best practices and a critique of the findings. *Journal of Science Teacher Education*, *23*(3), 291-318. https://doi.org/10.1007/s10972-012-9275-2

Cochran-Smith, M., & Lytle, S. L. (1999). Relationships of knowledge and practice: Teacher learning in communities. *Review of Research in Education*, *24*(1), 249-305.

Crawford, B. A. (2000). Embracing the essence of inquiry: New roles for science teachers. *Journal of Research in Science Teaching*, *37*(9), 916-937. https://doi.org/10.1002/1098-2736(200011)37:9<916::AID-TEA4>3.0.CO;2-2

Dori, Y. J., & Herscovitz, O. (2005). Case-based long-term professional development of science teachers. *International Journal of Science Education*, *27*(12), 1413-1446. https://doi.org/10.1080/09500690500102946

The Education Reform Initiative. (2017). *Education monitoring report 2016-2017*. Sabancı University Press.

European Commission. (2018). *Teaching careers in Europe: Access, progression and support*. Publications Office of the European Union.

Fraenkel, J. R., Wallen, N. E., & Hyun, H. H. (2012). *How to design and evaluate research in education* (8th ed.). McGraw-Hill.

Garet, M. S., Porter, A. C., Desimone, L., Birman, B. F., & Yoon, K. S. (2001). What makes professional development effective? Results from a national sample of teachers. A*merican Educational Research Journal*, *38*(4), 915-945. https://doi.org/10.3102/00028312038004915

Gökmenoğlu, T., & Clark, C. M. (2015). Teachers' evaluation of professional development in support of national reforms. *Issues in Educational Research*, *25*(4), 442-459.

Hendriks, M., Luyten, H., Scheerens, J., Sleegers, P., & Steen, R. (2010). *Teachers' professional development. Europe in international comparison. An analysis of teachers' professional development based on the OECD's teaching and learning international survey (TALIS)*. Office for Official Publications of the European Union.

Kleine, K., Brown, B., Harte, B., Hilson, A., Malone, D., Moller, K., … & Walker, B. (2002). Examining inquiry. *Principal Leadership: Middle Level Edition*, *3*(3), 36-39.

Kocagül, M. (2013). *The effect of inquiry based professional development activities on elementary science and technology teachers' science process skills and self-efficacy and inquiry based teaching beliefs* [Unpublished master's thesis]. Dokuz Eylül University Institute of Educational Sciences.

Marshall, J. C., Horton, R., Igo, B. L., & Switzer, D. M. (2009). K-12 science and mathematics teachers' beliefs about and use of inquiry in the classroom. *International Journal of Science and Mathematics Education*, *7*(3), 575-596. https://doi.org/10.1007/s10763-007-9122-7

Miles, M. B., & Huberman, A. M. (1994). *Qualitative data analysis: An expanded sourcebook* (2nd ed.). Sage Publishing.

Ministry of National Education (2017). *Teacher strategy paper 2017-2023*. http://oygm.meb.gov.tr/meb_iys_dosyalar/2017_07/26174415_Strateji_Belgesi_RG-Ylan _26.07.2017.pdf

Ministry of National Education (2018). *Science course curriculum (elementary and secondary school 3rd, 4th, 5th, 6th, 7th, and 8th grades).* http://mufredat.meb.gov.tr/Files/201812312311937-FEN%20B%C4%B0L%C4%B0MLER%C4%B0%C3%96%C4%9ERET%C4%B0M%20PROGRAMI2018.pdf

Muslu, N., Okulu, H. Z., Senler, B., Arabacioglu, S., Ozdem Yilmaz, Y., & Oguz Unver, A. (2022). Determining in-service teachers' professional development expectations: An instrument development study. *International Journal on Social and Education Sciences (IJonSES),* 4(3), 338-357. https://doi.org/10.46328/ijonses.420

National Research Council. (2012). *A framework for K-12 science education: Practices, crosscutting concepts, and core ideas*. National Academy Press.

Oguz Unver, A., & Okulu, H. Z. (2022). Encouraging Creative Ideas in the Engineering Design Process for Science Classes. *International Journal of Research in Education and Science (IJRES),* 8(3), 486-501. https://doi.org/10.46328/ijres.2920

Oguz Unver, A., Okulu, H. Z., Bektas, O., Ozdem Yilmaz, Y., Muslu, N., Senler, B., & Arabacioglu, S. (2022). Development of a scientific inquiry-supported classroom observation protocol (Manuscript submitted for publication).

Organisation for Economic Cooperation and Development. (2009). *Creating effective teaching and learning environments: First results from TALIS*. http://www.oecd.org/education/school/43023606.pdf

Penuel, W. R., Fishman, B. J., Yamaguchi, R., & Gallagher, L. P. (2007). What makes professional development effective? Strategies that foster curriculum implementation, *American Educational Research Journal, 44*(4), 921-958. https://doi.org/10.3102/0002831207308221

Phillips, P. (2008). Professional development as a critical component of continuing teacher quality. *Australian Journal of Teacher Education, 33*, 37-45.

Putnam, R. T., & Borko, H. (2000). What do new views of knowledge and thinking about research on teacher learning? *Educational Researcher, 29*(1), 4-15. https://doi.org/10.3102/0013189X029001004

Richards, J., Altshuler, M., Sherin, B. L., & Sherin, M. G. (2020). Orchestrating for seeing: How teachers see and help others see student thinking when self-capturing classroom video. In M. Gresalfi, & I. S. Horn (Eds.), *The interdisciplinarity of the learning sciences* (pp. 1942-1949, vol 4.). International Society of the Learning Sciences.

Richards, J., Altshuler, M., Sherin, B. L., Sherin, M. G., & Leatherwood, C. J. (2021). Complexities and opportunities in teachers' generation of videos from their own classrooms. *Learning, Culture and Social Interaction,* 28. https://doi.org/10.1016/j.lcsi.2021.100490

Sherin, M. G., Richards, J., & Altshuler, M. (2021). Learning from recording video of your own classroom. *Phi Delta Kappan*, *103*(2), 44-48. https://doi.org/10.1177/00317217211051144

Simon, S. (2012). Effective continuous professional development in science education. In Bolte, C., Holbrook, J., & Rauch, F. (Eds.), *Inquiry-based science education in Europe: Reflections from the PROFILES project*. The Free University.

Senler, B., Ozdem Yilmaz, Y., Oguz Unver, A., Muslu, N., Okulu, H. Z., & Arabacioglu, S. (2022). Adaptation of the scale of teacher opinions for scientific inquiry in teaching. (Manuscript submitted for publication).

Taitelbaum, D., Mamlok-Naaman, R., Carmeli, M., & Hofstein, A. (2008). Evidence for teachers' change while participating in a continuous professional development program and implementing the inquiry approach in the chemistry laboratory. *International Journal of Science Education*, *30*(5), 593-617. https://doi.org/10.1080/09500690701854840

West, P. (2002). 21st century professional development: The job-embedded, continual learning model. *American Secondary Education, 30*(2), 72.

Author Information

Ayse Oguz Unver
https://orcid.org/0000-0003-2938-5269
Mugla Sitki Kocman University
Turkey
Contact e-mail: *ayseoguz@mu.edu.tr*

Hasan Zuhtu Okulu
https://orcid.org/0000-0002-2832-9620
Mugla Sitki Kocman University
Turkey

Nilay Muslu
https://orcid.org/0000-0002-7429-5142
Mugla Sitki Kocman University
Turkey

Yasemin Ozdem Yilmaz
https://orcid.org/0000-0002-7688-1268
Mugla Sitki Kocman University
Turkey

Burcu Senler
https://orcid.org/0000-0002-8559-6434
Mugla Sitki Kocman University
Turkey

Sertac Arabacioglu
https://orcid.org/0000-0003-0002-8647
Mugla Sitki Kocman University
Turkey

Onur Bektaş
https://orcid.org/0000-0002-7735-5649
Mugla Sitki Kocman University
Turkey