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Teachers' Views on Scientific Inquiry Teaching: Reflections from an E-Mentoring Professional Development Program

Onur Bektaş [1] *, Ayşe Oğuz Ünver [2]

[1] ODTÜ Geliştirme Vakfı Schools, Turkiye, 0000-0002-7735-5649
[2] Muğla Sıtkı Koçman University, Turkiye, 0000-0003-2938-5269
* Corresponding author: Onur Bektaş (bektas.onurr@gmail.com)

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Abstract

This study explores teachers' views on scientific inquiry-based teaching following their participation in an e-mentoring professional development program. Ten teachers from Western Anatolia (five science and five classroom teachers) were interviewed using a semi-structured protocol designed to investigate their experiences, challenges, and reflections on implementing inquiry in the classroom. The interview tool, developed through expert feedback and pilot testing, included eight open-ended questions with follow-up prompts to elicit in-depth responses. Data were collected via online interviews, transcribed, and analyzed using MAXQDA. Findings indicate that teachers valued scientific inquiry for its potential to promote student curiosity, engagement, and critical thinking. However, they reported significant barriers, including time constraints, limited resources, and the need for sustained professional support. Teachers also highlighted the importance of creating a supportive classroom climate and redefining their instructional roles within inquiry-based lessons. The study underscores the value of tailored professional development initiatives that address teachers' specific contexts and needs. Recommendations include the integration of interactive reflection tools, structured peer collaboration, and ongoing mentorship to strengthen teachers' confidence and competence in scientific inquiry pedagogy.

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Introduction

Scientific inquiry-based teaching has gained significant traction in science education due to its ability to enhance students' critical thinking, problem-solving, and engagement in scientific processes (Abd-El-Khalick & Lederman, 2000; Crawford, 2007; Keys & Bryan, 2001). However, its implementation in classrooms presents challenges for teachers (e.g. Crawford, 2007; Marshall et al., 2009). Yet, the successful implementation of scientific inquiry practices is directly related to teachers' perceptions, beliefs, and professional competence towards this method (Bryan, 2003). In this context, examining teachers' views on scientific inquiry is important for improving educational practices.

Scientific Inquiry Teaching

Scientific inquiry involves asking questions, collecting and analyzing data, drawing conclusions, and engaging in scientific argumentation (National Research Council [NRC], 2012). Inquiry-based learning has been widely recognized as an effective approach for fostering deep understanding of scientific concepts (Hmelo-Silver et al., 2007). However, research suggests that teachers often face difficulties in implementing inquiry due to a lack of pedagogical content knowledge, limited resources, and the constraints of standardized curricula (Crawford, 2007).

Teachers' beliefs about scientific inquiry significantly impact their instructional practices. Studies indicate that teachers who possess strong epistemological beliefs about inquiry tend to create more student-centered learning environments (Brickhouse, 1990). Conversely, those who view scientific knowledge as static and absolute may struggle with implementing inquiry-based approaches effectively. Teachers' perceptions of inquiry-based teaching vary based on their experiences, professional training, and institutional support (Marshall et al., 2009). Li, Moorman, and Dyjur (2010) investigated the experiences of Canadian rural teachers and found that while they recognized the benefits of inquiry-based learning, they faced obstacles such as limited instructional time, assessment challenges, and a lack of inquiry-aligned teaching materials. Similarly, research by Kang (2023) highlights the tension between teachers' enthusiasm for inquiry and their perceived ability to manage student-led investigations in real classroom settings. The study found that teachers required ongoing support to transition from traditional didactic methods to inquiry-based strategies.

The Role of E-Mentoring in Teacher Professional Development

E-mentoring has been recognized as an effective strategy for supporting teachers in professional development, especially in the context of scientific inquiry teaching. Unlike traditional face-to-face mentoring, e-mentoring allows for asynchronous and synchronous communication, making it a viable option for teachers in remote areas (Tinoco-Giraldo et al., 2020). Recent studies have explored the impact of e-mentoring on teacher retention and instructional confidence. Blackburn (2020) found that e-mentoring played a crucial role in reducing teacher attrition in underprivileged areas by providing emotional and pedagogical support. Another study by Hunt et al. (2013) showed that e-mentoring enhanced novice teachers' perceptions of their teaching competencies, particularly in handling inquiry-based lessons.

Benefits and Challenges of E-Mentoring for Inquiry-Based Teaching

E-mentoring has become a valuable professional development tool for teachers engaged in scientific inquiry-based teaching, offering personalized support, community building, resource sharing, and continuous professional development. By providing individualized guidance, e-mentoring helps educators address specific instructional challenges, particularly those new to inquiry-based methods or in under-resourced settings (Unver et al., 2023). It also fosters collaboration among teachers from different locations, enabling them to share best practices and engage in reflective teaching (Peila, 2020). Additionally, digital platforms facilitate access to inquiry-based lesson plans and assessments, enhancing instructional quality (Choi, Seung & Kim, 2021; Kaçar & Baltacı, 2023). Unlike traditional workshops, e-mentoring ensures sustained engagement, allowing teachers to continuously refine their teaching strategies through ongoing mentor and peer interactions (Elsayed, 2021).

Despite its benefits, e-mentoring in scientific inquiry-based teaching faces challenges, including technological proficiency, institutional support, and sustained engagement. Some teachers, particularly those with limited digital literacy, struggle to navigate online mentoring platforms, limiting their participation (Legler, 2021). Additionally, many schools lack the infrastructure, policies, and resources to integrate e-mentoring into professional development, reducing its long-term effectiveness (Kuru et al., 2022). Maintaining teacher engagement is also challenging, as online programs often experience fluctuating participation without social accountability. Implementing incentives, recognition programs, and structured check-ins can help sustain motivation and maximize the impact of e-mentoring (Chaeruman et al., 2024).

Findings in the literature show that scientific inquiry is an effective method in science education and professional development programs play a critical role in teachers' adoption of this method. However, the difficulties that teachers encounter while implementing scientific inquiry practices limit the dissemination of this method. In this context, the aim of the study is to examine teachers' views on scientific inquiry-supported science teaching and the effects of the e-mentoring process on these views, and to reveal the importance of support mechanisms for teachers in disseminating scientific inquiry in science education.

Method

In the present study, it is aimed to explore teachers' opinions of scientific inquiry teaching through insights from an e-mentoring professional development program. For this reason, the research was designed as a case study.

Study Group

The participants of the study comprised a total of 10 teachers, including five science teachers and five classroom teachers working in Western Anatolia. Criterion sampling, a purposive sampling method, was employed for participant selection. This approach was adopted due to the participants' involvement in a national research initiative focused on the design and evaluation of an online e-mentorship model for in-service teacher training, supported by scientific inquiry.

Table 1 presents the demographic characteristics of the teachers participating in the study, including their gender, field of expertise, professional experience, school type, grade level, class size, and the subject of the recorded lesson. The participants, most of whom are female teachers, work in various educational institutions such as public schools and science-art centers, teaching at grade levels ranging from 2nd to 6th grade.

Table 1. Demographic Characteristics of Participants

Participant Code	Gender	Branch	Experience	School Type	Grade Level	Class Size	Class Organization	Course Subject
T1	Male	Science	15	Public	5	16	U-shaped computer lab.	The impact of human activities on the environment
T2	Male	Science	16	Science and Art Center	5	3	Science classroom	Understanding the nature of science
T3	Female	Science	16	Public	6	19	Group seating	Speed and velocity measurement
T4	Female	Science	7	Private	6	13	Group seating	Floating and sinking
T5	Female	Science	13	Public	6	24	Narrow classroom with limited mobility in group seating arrangement	Friction force
T6	Female	Elementary	20	Public	2	27	Narrow classroom with limited mobility in group seating arrangement	The shape and movements of the earth
T7	Female	Elementary	22	Public	1	22	Traditional seating arrangements	Life of bees
T8	Female	Elementary	18	Public	3	32	Narrow classroom with limited mobility in group seating arrangement	Plant life
T9	Female	Elementary	26	Public	3	24	Narrow classroom with limited mobility in group seating arrangement	Artificial intelligence
T10	Female	Elementary	13	Public	4	30	Group seating	Separation methods of mixtures

Project E-Mentoring Implementation Process

This four-stage e-mentoring implementation process offers a mutual dialogue platform on which the needs and expectations of each and every teacher is addressed independently from one another. The process involved teachers (mentees) uploading their lesson videos to the digital platform, then mentors and mentees evaluate these lessons within the framework of the observation protocols and finally mentor–mentee online meetings. The stages of this process are shown in Figure 1.

Figure 1. In-service Teacher Training Mentoring Model for Scientific Inquiry Teaching (Author et al., 2023b, sf. 282)

Data Collection Process

The research employed a semi-structured interview approach, with questions developed to explore teachers' experiences, challenges, and reflections on implementing scientific inquiry in their classrooms. The interview questions were designed based on a framework that integrates teachers' knowledge, beliefs, and classroom practices, ensuring alignment with the study's objectives. Key themes included teachers' roles in inquiry-based lessons, classroom climate, student engagement, and professional growth. Data were collected via Zoom-based interviews. At the beginning of the interview, the researcher provided information to the participant such as self-introduction, the purpose of the interview, the estimated interview duration, a general introduction to the research process, and data confidentiality, thus ensuring that similar conditions were created in the interviews.

Introduction of the Measurement Tool: Scientific Inquiry Teacher Interview Form

An examination of the structure of the Scientific Inquiry Teacher Interview Form reveals that it consists of questions designed to explore teachers' perspectives and experiences. The form comprises eight questions, each accompanied by follow-up probes aimed at eliciting in-depth responses. The interview questions were developed to enable teachers to articulate their observations, expectations, and experiences by comparing lessons that incorporate scientific inquiry with those that do not. Within this framework, teachers were asked to reflect on their roles and responsibilities, as well as those of their students, in inquiry-based lessons. Additionally, they were encouraged to discuss classroom climate and communication, aspects they appreciated or found challenging, their students' development, and their own professional growth. These reflections were specifically framed within the context of scientific inquiry-supported instruction. The overall structure of the interview form also includes sections for recording the date of the interview, its start and end times, the participant code, and the stage of the research at which the interview was conducted (see Appendix).

To ensure validity, the interview questions developed by the researcher were refined through discussions with a subject-matter expert to ensure an objective examination of the phenomenon under investigation (Kirk & Miller, 1986). Based on expert recommendations, follow-up probes were added to the eight main questions to facilitate deeper exploration. In this study, the reliability of the instrument was established through the concepts of consistency and confirmability (Lincoln & Guba, 1985). To ensure consistency, all interviews were conducted using a standardized approach and recorded via video. During data analysis, themes were generated by considering both the literature and the structure of the data, ensuring coherence and reliability.

Data Analysis

The interviews conducted via video conferencing were archived for analysis, labeled with the interview date and the participant's unique code. The analysis of the interview recordings followed a four-step process: (1) coding the data, (2) identifying themes, (3) organizing and describing the data based on codes and themes, and (4) interpreting the findings. The coding process was carried out using MAXQDA qualitative data analysis software. Once the coding was completed in the transcript documents, code maps were generated to systematically structure the data.

Results

Table 2 shows the distribution of the coding from the teachers' interview transcripts according to the themes.

Table 2. Frequency Distribution of Coding According to Themes in the Interview Transcripts

Themes	**f**
Teaching Methodology	153
Teacher's Roles and Responsibilities	52
Student's Roles and Responsibilities	35
Communication	56

Themes	**f**
Positive Feedback	43
Challenges	68
Students' Development	62
Professional Development	38
Total	507

Upon examining Table 2, it can be seen that a total of 507 different codings were made in the transcript files of the interviews conducted with 10 teachers. Each of the themes is associated with a question in the interview form. The frequency distribution of the codings across the themes varies between 35 and 153 codings. Accordingly, the theme with the fewest codings is "Student's Roles and Responsibilities," while the theme with the most codings is "Teaching Methodology."

Findings Related to The Responses in The Teaching Methodology Theme

The participant teachers, when comparing scientific inquiry practices with other lessons, evaluated the differences in teaching methodologies within the framework of sub-codes such as planning, implementation and activities, assessment process, physical learning environment, learning process, and time management. While some teachers (T1, T2, T3) indicated that inquiry-based lessons are time-consuming, others (T4) pointed out their positive effects on time management. Overall, teachers expressed that they needed more time for these types of lessons. However, they also mentioned that the e-mentoring process helped them adapt to the lessons more easily (T7). It was emphasized that proper planning could reduce time management issues (T2, T10). It was also found that the preparation phase for inquiry-based lessons takes longer compared to other lessons (T9).

In the planning phase, it was emphasized that the retention of information can be achieved in a shorter period of time (T10) and that the stepwise structure of scientific inquiry requires planning skills. It was particularly noted that knowledge of the nature of philosophy and science is important (T9). Due to the different stages involved in scientific inquiry and its appeal to various student skills, it was stated that planning plays a critical role (T7). Teachers indicated that student participation increased in scientific inquiry-supported lessons (T1, T4, T8) and that students' motivation also rose (T4). Additionally, teachers' expectations and practices regarding students also differed during this process. For example, the teacher with code T2 expressed that they directed students according to the types of questions. The teacher with code T10, on the other hand, critically evaluated their approach of giving students responsibility and focusing on control.

Regarding the learning process, teachers emphasized the importance of preparation to prevent misconceptions (T9). The diversity and richness of the questions were noted to have a positive impact on students' curiosity and the learning process (T8). It was emphasized that scientific inquiry-supported lessons are more advantageous compared to rote-learning processes and that the information learned is more permanent (T5). Furthermore, teachers stated that the outcomes and student participation in these types of lessons are more effective (T3). In terms of the assessment process, teachers mentioned that in scientific inquiry-supported lessons, it is beneficial for students to relate the topic to daily life (T3). The teacher with code T4 stated that it is easier to identify students' deficiencies during the lesson in such classes. Some teachers, with the help of e-mentoring support, have integrated the assessment phase into their lessons (T10).

The figure illustrating the relationships between the responses provided by teachers in relation to the teaching methodology theme is presented in Figure 2.

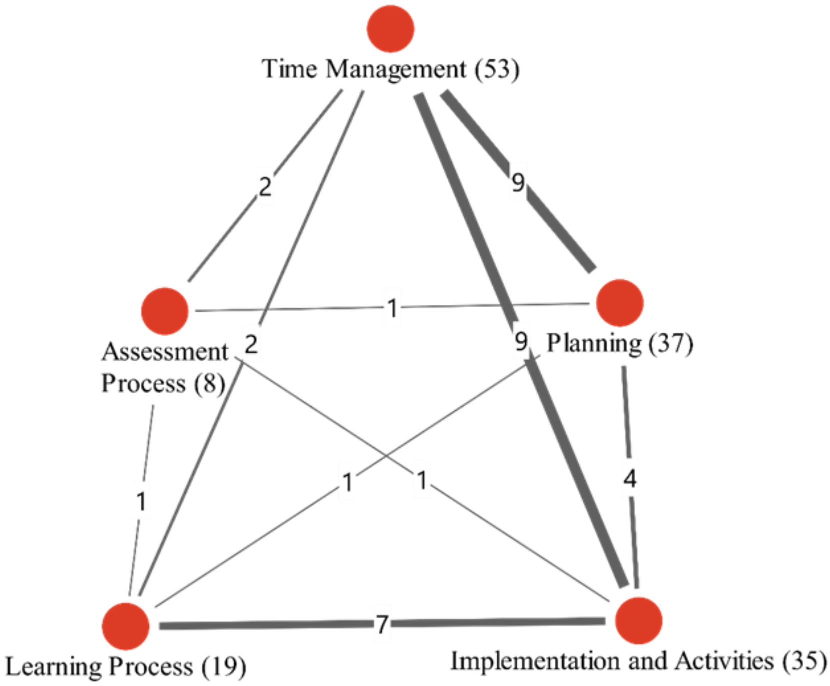

Figure 2. Code Relationships for the Teaching Methodology Theme

Upon examining Figure 2, it can be seen that five out of the six sub-codes related to the teaching methodology theme are interconnected. As a result, the participating teachers indicated that scientific inquiry-supported lessons enhance student participation and motivation, and make the learning process more effective and lasting. However, it was emphasized that these types of lessons require more time and preparation during the planning and implementation phases. The e-mentoring process has facilitated teachers' adaptation to scientific inquiry methods and made the assessment processes more functional. Teachers expressed that with proper planning and continuous mentoring support, this method can be successfully implemented.

Findings Related to The Responses in The Teacher's Role and Responsibilities Theme

Teachers evaluated their roles and responsibilities in scientific inquiry-supported lessons within the framework of planning, implementation and activities, assessment, physical learning environment, and learning sub-codes. In this process, the correct planning of teachers' administrative and in-class duties emerged as an important distinction (T2). The stepwise nature of scientific inquiry supported lessons increased teachers' guiding role and expanded their responsibilities in stages such as prediction, observation, data collection, analysis, and inference (T3). Teachers took on new responsibilities, such as providing guidance to students and assigning research tasks (T6). Additionally, it was noted that the pre-lesson preparation phase was more comprehensive, with a focus on stimulating students' curiosity and sense of discovery (T10).

In the process of implementation and activities, teachers emphasized the importance of classroom management skills (T2, T5). Ensuring full student participation in activities required teachers to provide continuous monitoring and guidance (T3). In scientific inquiry-supported lessons, it was noted that both teachers and students were stakeholders in the process, with responsibilities shared and carried out collaboratively (T4, T6, T10). Regarding the learning process, teachers indicated that scientific inquiry-supported lessons increased student participation and facilitated lasting learning (T1, T5, T10). Teachers defined their roles as stimulating students' curiosity, promoting interaction with materials, and supporting enduring learning. In the assessment process, T10-coded teacher expressed that by engaging students in problem-solving activities, they focused on addressing students' deficiencies. In this process, improving students' problem-solving skills was identified as a primary goal. Regarding the physical learning environment, teachers reported that they adapted the classroom setup to be suitable for group work and prepared the activity materials in advance (T3, T8). However, challenges such as overcrowded classrooms, lack of laboratories, and inadequate physical resources were also mentioned (T5). Teachers emphasized that while these difficulties could be partially mitigated by teachers' skills, improvements in physical conditions were necessary.

The figure illustrating the codes associated with the theme of teacher roles and responsibilities is presented in Figure 3.

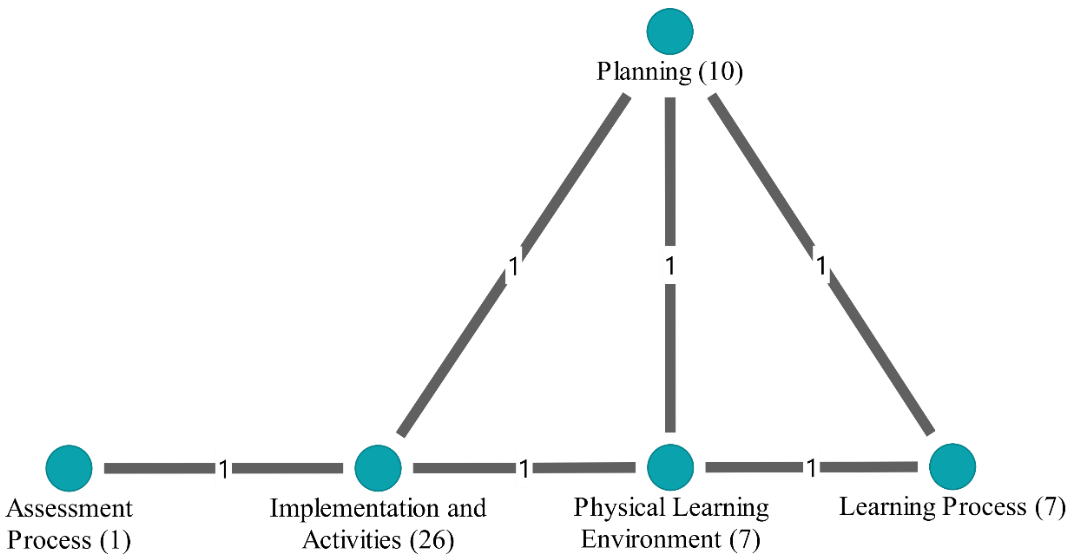

Figure 3. Code Relationships for The Teacher Roles and Responsibilities Theme

Figure 3 illustrates the co-occurrence levels of five codes. In conclusion, teachers stated that their roles and responsibilities in scientific inquiry-supported lessons have become more comprehensive and guidance-oriented. In this process, fostering students' curiosity and exploratory skills, ensuring permanent learning, and supporting full participation in activities have emerged as primary objectives. However, challenges such as overcrowded classrooms, insufficient physical resources, and the lack of laboratory facilities were identified as major obstacles in implementing this approach. Teachers emphasized that while some of these difficulties could be mitigated through teacher competencies, improving the physical conditions of schools remains essential.

Findings Regarding Responses on the Theme of Student Roles and Responsibilities

Teachers' perspectives on students' roles and responsibilities in scientific inquiry-supported lessons were coded under planning, implementation and activities, learning process, physical learning environment, and assessment. During the planning process, teachers focused on students’ classroom behavior and homework assignments. Teacher T1 stated that they prepared questions in advance to encourage students to think and draw inferences. Teacher T2 mentioned supporting this process by assigning homework. Teacher T10 emphasized encouraging students to actively participate in classroom activities and share their opinions. In the implementation and activities process, students were expected to design research to solve their own problems and collaborate in group work (T1, T2, T3, T6, T10). Teacher T3 highlighted students' collaboration, joint decision-making, and implementation skills. Teacher T6 mentioned that students assumed small tasks such as distributing materials to their peers. Teacher T10 underscored students' responsibility for reflecting on activity stages. Overall, students were portrayed not as passive learners but as active participants in the process.

Regarding the learning process, teachers emphasized that students were responsible for their own learning and that they felt this responsibility (T1, T3, T4, T10). Teachers T1 and T4 highlighted students’ responsibility for structuring the learning process, while teacher T10 stated that students enjoyed this process. Additionally, teachers agreed that scientific inquiry-supported lessons facilitated long-term retention of knowledge. Concerning the physical learning environment, teachers noted that they tried to keep students engaged by assigning them specific roles and responsibilities in crowded classrooms (T8). Furthermore, practices such as having students procure activity materials and share responsibilities were emphasized. Throughout this process, students' collaboration and sense of responsibility were fostered. The relationships between the codes related to students' roles and responsibilities are illustrated in Figure 4.

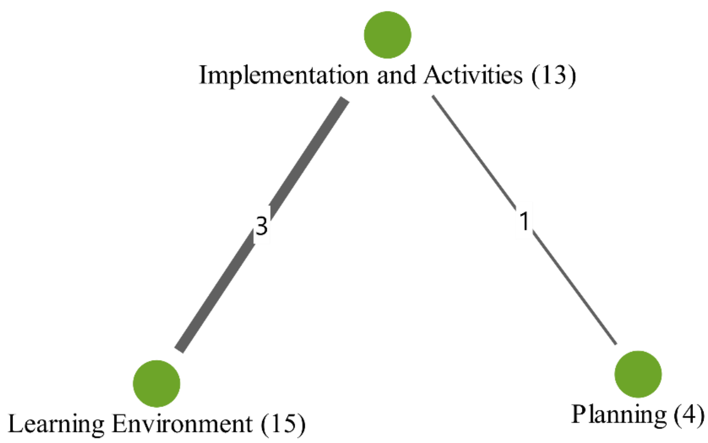

Figure 4. Code Relationships for the Theme of Student Roles and Responsibilities

In conclusion, as seen in Figure 4, scientific inquiry-supported lessons promote students' sense of responsibility and active engagement in learning processes.

Findings Regarding Responses on the Theme of Communication

Teachers stated that classroom communication and interaction in scientific inquiry-supported lessons differed in terms of planning, implementation, assessment, and the physical learning environment. During the planning process, teachers arranged seating to enable students to work with different peers. Teacher T2 mentioned using pre-prepared questions to enhance student communication. This approach played a facilitative role in encouraging students to express their opinions. During the implementation process, teachers observed an increase in classroom communication in scientific inquiry-supported lessons. Teacher T1 noted that this increase had a positive impact on students' academic achievement. Teacher T3 stated that grouping students with different peers fostered a culture of collaboration. Teacher T5 emphasized that students felt more comfortable expressing themselves, whereas teacher T7 highlighted that the pressure to complete curriculum activities negatively affected communication. However, teacher T7 also stated that this challenge could be mitigated through scientific inquiry. In the assessment process, teachers indicated that classroom communication was linked to academic achievement and evaluation methods. Teacher T8 pointed out that variations in students' academic test scores were related to communication. Teacher T10 emphasized that uniform assessment methods hindered peer learning. Regarding the physical learning environment, teachers reported that classroom arrangements positively influenced communication (T2, T3, T6). However, they also noted that challenges such as overcrowded classrooms and limited school resources negatively impacted communication. The relationships between the codes related to classroom communication are illustrated in Figure 5.

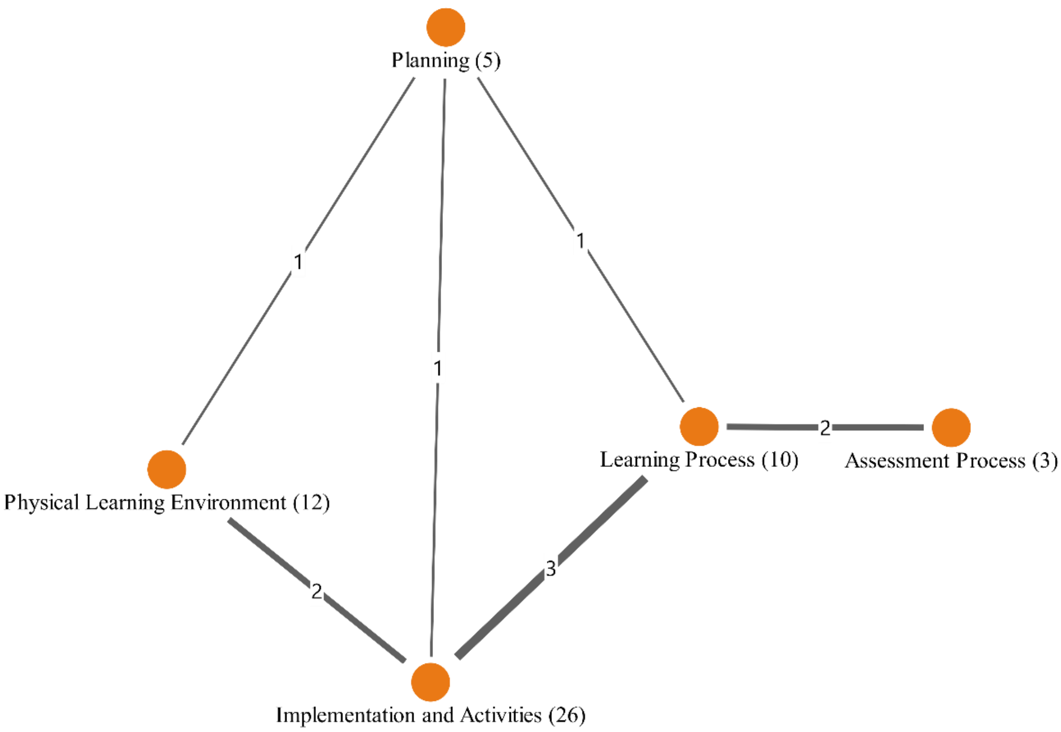

Figure 5. Code Relationship for the Theme of Communication

As seen in Figure 5, teachers concluded that scientific inquiry-supported lessons positively influenced students' academic achievement, collaboration, and self-expression skills through enhanced classroom communication and interaction. Planning and implementation strategies, such as seating arrangements, peer groups, and encouraging questions, were found to be effective in improving student communication. However, challenges such as overcrowded classrooms and limited school facilities emerged as factors negatively affecting classroom communication. Teachers emphasized that the scientific inquiry approach was an effective tool in overcoming these challenges.

Findings Regarding Responses on the Theme of Positive Feedback

Teachers evaluated their positive feedback on scientific inquiry-supported lessons in terms of planning, implementation, assessment, the physical learning environment, and the learning process. During the planning process, teachers stated that time management was effectively maintained and that prior preparation facilitated the process. Teacher T4 emphasized this by stating, “It ensures time management,” while teacher T10 highlighted the efficiency of planning by saying, “We accomplish greater tasks in a shorter time.” Additionally, teachers reported gaining self-confidence and enjoying the planning process (T1, T3, T4). In the implementation and activity process, teachers identified stimulating students' curiosity and sense of discovery, supporting group work and collaboration, as positive aspects. Encouraging students to take responsibility and enabling a student-centered teaching process were also highlighted as key benefits. Teacher T5 expressed that taking on a guiding role and supporting students in research processes was important to them. Teacher T8, on the other hand, noted that they developed themselves through this process, emphasizing that scientific inquiry also provides a learning opportunity for teachers.

Regarding the learning process, teachers found scientific inquiry to be aligned with the nature of science, evidence-based reasoning, and the promotion of a discussion culture. Teacher T2 appreciated that students supported their claims with evidence, while teacher T3 stated that scientific inquiry contributes to developing a culture of discussion in society. Teacher T4 emphasized that the ability to openly express unclear concepts in the classroom supported the learning process. In the assessment process, teachers viewed students' self-assessment and product evaluation processes positively. Teachers T3 and T10 highlighted the importance of students assessing themselves, while teacher T7 stated that the product evaluation process was effective. The relationships between the codes related to positive feedback are illustrated in Figure 6.

In conclusion, teachers stated that scientific inquiry-supported lessons have many positive features in the planning, implementation, and assessment processes. Teachers expressed that time management became easier and that they gained self-confidence during the planning phase. In the implementation process, they emphasized that students' curiosity, discovery, and collaboration skills improved. Additionally, the alignment of scientific inquiry with the nature of science, its support for a discussion culture, and students' self-assessment were highlighted as prominent positive aspects. Teachers believe that this method provides learning and development opportunities for both students and themselves.

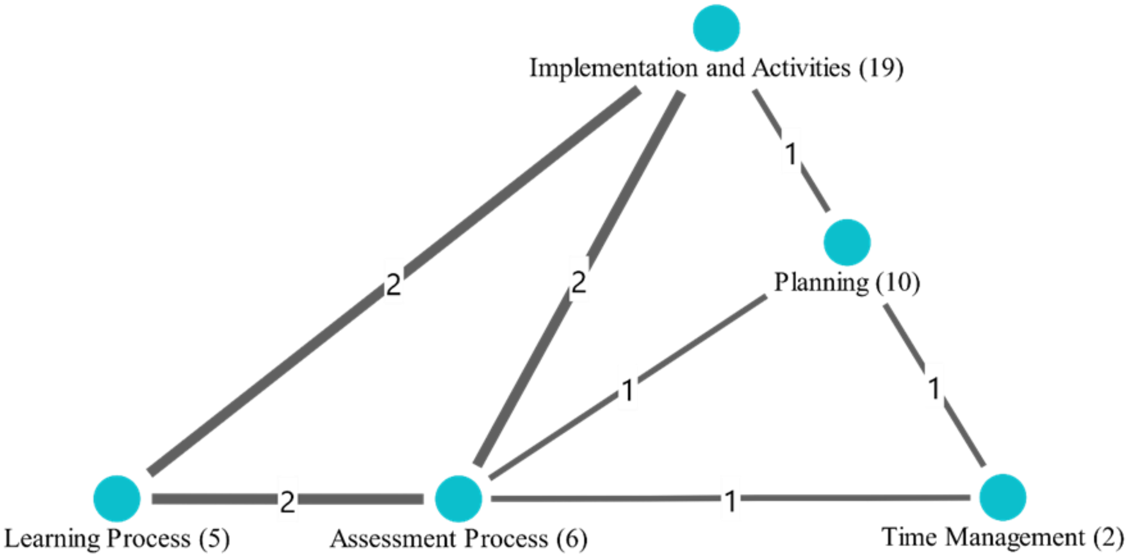

Figure 6. Code Relationship for the Theme of Positive Feedback

Findings Regarding Responses in The Theme of Challenges

Teachers evaluated their challenges on scientific inquiry-supported lessons in terms of planning, implementation, assessment, physical learning environment, and learning process. In the planning process, teachers stated that they were unable to allocate sufficient time for planning due to the intensity of their other duties at school (T4). Additionally, the need for knowledge accumulation in the planning process and teachers feeling inadequate were also highlighted as challenges (T8). Teachers believe that having activities in textbooks designed as scientific inquiry-supported would reduce the planning burden. In the implementation process, teachers expressed the difficulty of formulating encouraging questions to ensure students' participation in the lesson (T1, T2, T6). Furthermore, the existing exam system, influencing both student and parent expectations, limits the teachers' ability to implement scientific inquiry practices. Teacher T3 noted that due to students' focus on test-taking and parents' expectations in this regard, it was challenging to implement scientific inquiry practices.

Regarding the learning process, teachers stated that students' lack of prior knowledge and low levels of readiness made the learning process difficult (T1, T2). Moreover, the difficulty in guiding students to think critically was also mentioned as a key issue. In the assessment process, teachers indicated uncertainty in selecting the appropriate assessment methods and that the large class sizes made individual assessments difficult (T3, T5). Specifically, the difficulty of tracking and evaluating students' observation records was emphasized. Regarding the physical learning environment, teachers pointed out challenges in material procurement and the inadequacy of schools' physical facilities (T3, T10). Overcrowded classrooms were also mentioned as a problem negatively affecting the teaching process. The relationships between the codes formed under the challenges theme are shown in Figure 7.

In conclusion, as seen in Figure 7, teachers stated that they faced various challenges in the planning, implementation, assessment, and physical learning environment in scientific inquiry-supported lessons. The main issues in the planning process were time constraints and lack of knowledge accumulation, while in the implementation phase, ensuring student participation and coping with the pressure of the exam system were difficult. Students' lack of prior knowledge and low levels of readiness negatively affected the learning process, while overcrowded classrooms and inadequate physical facilities led to issues in assessment and material procurement. These findings suggest that teachers require more support and resources for the widespread implementation of scientific inquiry practices.

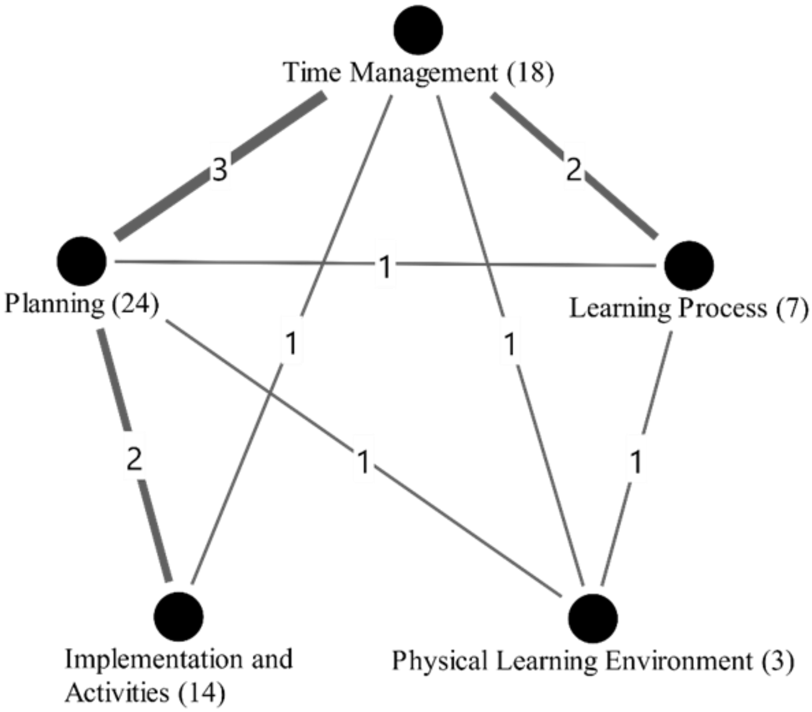

Figure 7. Code Relationship for the Theme of Challenges

Findings Related to Responses in The Theme of Student Development

Teachers reported that students demonstrated development in cognitive, affective, social, and thinking skills within science inquiry-supported lessons. Cognitively, an increase in students' academic performance was observed. Teacher T1 stated that their class ranked first in the school, while Teacher T8 mentioned that all 38 students in their class received certificates of appreciation. Furthermore, it was emphasized that students made progress in creative thinking, critical thinking, scientific process skills, and problem-solving abilities (T3, T6, T10). Affectively, teachers noted improvements in students' motivation, self-confidence, and happiness levels (T1, T3, T5, T7, T8). However, it was also mentioned that students with weaker communication skills faced challenges during this process (T5). It was observed that students' self-confidence had increased, and they had stronger communication with their families (T7, T8).

Socially, teachers reported that students showed growth in expressing their thoughts within society, as well as in interaction, collaboration, and taking responsibility (T2, T3, T8, T10). It was observed that students' interactions within the classroom and with their peers had increased, and they were able to express their opinions with confidence. In terms of thinking skills, teachers noted that students had made progress in creative thinking, critical thinking, scientific process skills, and perceptual levels (T3, T6, T8). It was emphasized that students' problem-solving and inquiry skills also developed during this process. Throughout the implementation and activity phases, teachers observed improvements in students' ability to create products and conduct research (T3, T6). In particular, the use of Web 2.0 tools and hands-on learning processes were noted to enhance students' research capabilities. Regarding the learning process, teachers expressed that science inquiry-supported learning was more lasting and that students benefited more from experiential learning processes (T4, T6). It was emphasized that, during this process, a student-centered learning environment was preferred over teacher-based approaches. In the evaluation process, Teacher T8 attributed the improvement in students' academic success to the science inquiry-supported practices. The teacher stated that while the exam questions were not easy, the students' success increased through this method. The relationships between the codes formed under the students' development theme are shown in Figure 8.

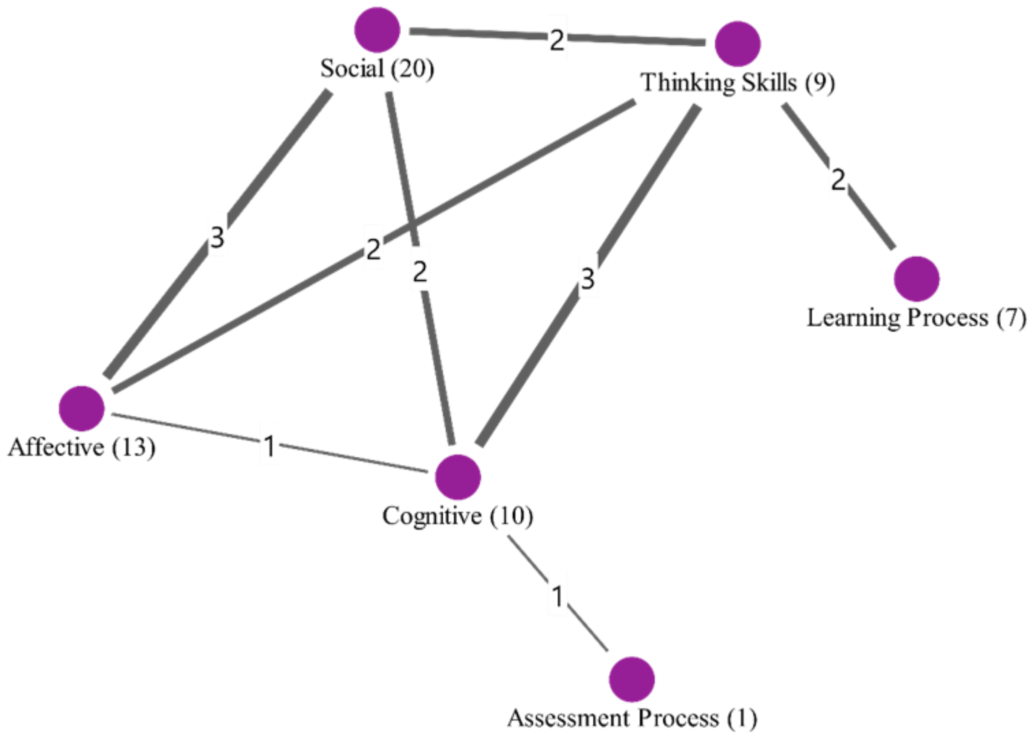

Figure 8. Code Relationship for the Theme of Students' Development

In conclusion, teachers have reported that science inquiry-supported lessons have led to significant developments in students' cognitive, affective, social, and thinking skills. In addition to improvements in students' academic performance, progress was observed in their creative and critical thinking, problem-solving, and scientific process skills. Furthermore, positive developments in students' motivation, self-confidence, and social interaction skills were also highlighted. Teachers stated that this method made the learning process more lasting and effective, with hands-on learning processes particularly contributing greatly to students' development.

Findings on the Responses Given in The Theme of Professional Development

Teachers reported significant gains in terms of planning, implementation, teacher characteristics, evaluation, physical learning environment, and learning process during the e-mentoring in-service training process. In the planning process, teachers stated that they made progress in time management and lesson planning. Teacher T10 mentioned that their concerns regarding time management were reduced with e-mentoring support and that they were able to apply the steps they had missed in their lessons step by step. Additionally, teachers emphasized that they gained confidence during the planning process and were able to design and implement lesson plans more effectively (T1, T2, T3, T6). In the implementation and activities process, teachers reported improvement in material selection and activity design. They also expressed that by evaluating their practices through video recordings and feedback, they were able to develop their professional skills. During this process, the diversity and effectiveness of the materials used in the activities increased.

In terms of teacher characteristics, teachers mentioned that they developed their skills in managing the scientific inquiry process and were able to guide students' learning processes more effectively. Moreover, teachers stated that their professional satisfaction and motivation increased during this process. They also reported becoming aware of their deficiencies in subject knowledge and individual development and took steps to address these issues. Regarding the physical learning environment, teachers mentioned that they were able to organize the classroom environment in a more flexible and diversified way. Teachers, who also showed improvement in material selection and usage, emphasized the importance of adjusting the learning environment to meet students' needs. Regarding the learning process, teachers noted that scientific inquiry-supported lessons contributed to students' learning processes and that they also developed professionally during this process. Teachers mentioned that the development of students' reasoning and inquiry skills made them happy and increased their professional satisfaction. The relationships between the codes formed under the professional development theme are shown in Figure 9.

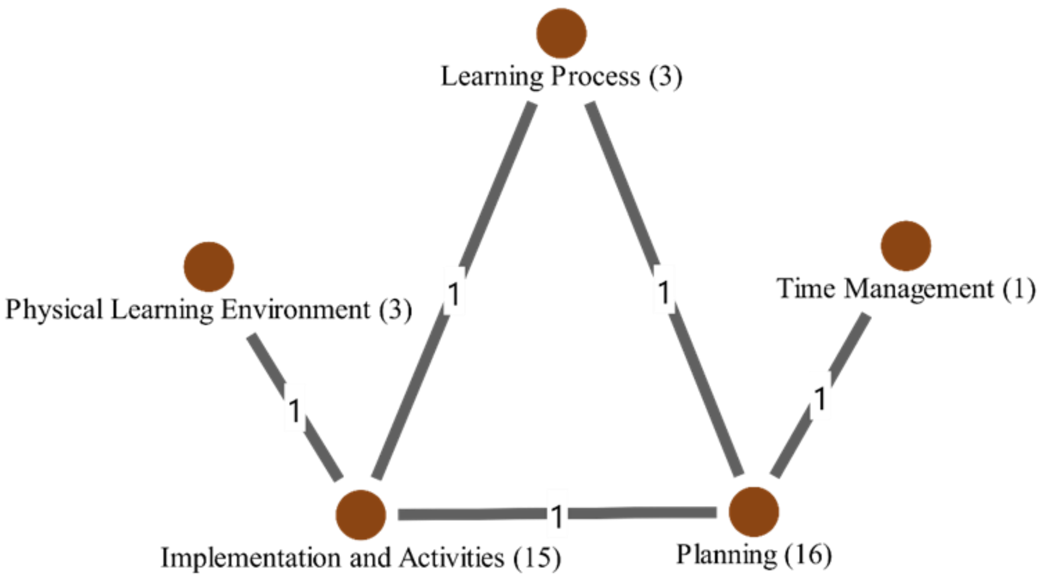

Figure 9. Code Relationship Diagram Based on the Coding for the Theme

Considering the code relationships presented in Figure 9, teachers stated that they gained significant improvements in terms of planning, implementation, teaching skills, and physical learning environment during the e-mentoring in-service training process. Teachers who showed progress in time management, lesson planning, and material selection expressed that they were able to manage the scientific inquiry process more effectively. Additionally, they emphasized that they were able to guide students' learning processes better and that their professional satisfaction and motivation increased during this process. Teachers, who were able to organize the physical learning environment in a more flexible and diversified way, believe that they enriched both their own professional development and the students' learning experiences during this process.

Discussion and Conclusion

This study explored teachers' views on scientific inquiry-based teaching within the context of an e-mentoring professional development program. The findings offer valuable insights into how e-mentoring can support the integration of inquiry-based teaching and the challenges teachers face in this process. The results align with existing research, but also highlight unique challenges that warrant further investigation. The findings are consistent with previous studies on scientific inquiry-based teaching, particularly the belief that inquiry is fundamental to science education (Bryan, 2003). Teachers in this study emphasized the importance of scientific inquiry for fostering critical thinking and problem-solving skills in students. These results mirror those of Herrenkohl, Tasker, and White (2011), who observed that inquiry promotes the use of scientific language and enhances communication. Teachers in this study similarly reported that students became more adept at using scientific terminology and engaging in discussions. This further supports the idea that scientific inquiry can develop students' cognitive and communicative abilities.

However, the study also revealed challenges not fully addressed in the literature. Teachers, particularly those in private schools, reported that extracurricular responsibilities significantly hindered their ability to plan and implement inquiry-based lessons. This issue, which was particularly pronounced among teachers with heavy administrative duties, limits their ability to effectively engage in scientific inquiry. These challenges highlight the importance of institutional support for professional development programs and the need for further research into the external factors that impact teachers' ability to engage with innovative teaching practices.

One of the strengths of this study is its focus on the role of e-mentoring in supporting teachers' professional growth. E-mentoring provided flexible and accessible support, allowing teachers to engage in ongoing reflection and feedback. Teachers appreciated this support, noting that it helped them shift from a teacher-centered to a student-centered approach, enhancing classroom communication and interaction. These findings are consistent with those of Baker et al. (2009), who found that e-mentoring fosters collaborative learning among teachers. E-mentoring also provided teachers with opportunities to reflect on and improve their pedagogical practices, contributing to their professional development. However, the study also identified limitations in the e-mentoring process. Some teachers faced challenges with digital tools, and the lack of face-to-face interaction hindered relationship-building with mentors. These challenges echo concerns raised by Roehrig and Luft (2004), who noted that technological barriers can limit the effectiveness of e-mentoring. Despite these limitations, the study highlights the potential of e-mentoring programs to support teachers' adoption of inquiry-based teaching, underscoring the need for improvements in digital access and mentor engagement.

In conclusion, the e-mentoring process has enhanced teachers' confidence in implementing scientific inquiry practices and enabled them to apply this approach more effectively. With the support of mentoring, teachers have overcome challenges related to time management, lesson planning, and instructional implementation. However, factors such as large class sizes and inadequate physical resources in schools have limited the implementation of scientific inquiry practices. These findings highlight that while scientific inquiry is an effective approach in science education, teachers require sustained support to successfully integrate it into their teaching practices.

Statements and Declarations

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During the preparation of this article, the authors did not use ChatGPT.

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Data Availability: The data that support the findings of this study are available from the corresponding author upon reasonable request.

Ethics Approval: All methods were performed in accordance with the study protocol and ethical guidelines and regulations.

Informed Consent: Informed consent was obtained from all subjects involved in the study.

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Appendix. Scientific Inquiry Teacher Interview Form

Date: ……/……/20…… **Interview Start/End Time:** _________ /__________

Participant Code:

Hello, my name is XXXX. I am conducting a study examining how the in-class implementation of scientific inquiry-supported science lessons changes during the in-service training process in terms of time management, lesson planning, teachers' perspectives, and student worksheets. Based on this, I believe that teachers' views on the scientific inquiry process and classroom practices are highly valuable. Thank you for your contribution to my research.

To address any concerns or questions you may have about the research process, I would like to explain the interview procedure. This interview will remain strictly confidential between you and me as the researcher. No other researcher, school administrator, or teacher will listen to or read the audio recordings and transcript documents related to this interview. Additionally, your name will remain anonymous throughout the research process and will be encrypted using a pseudonym.

Before we begin, is there anything you would like to mention or ask?

Would you like to proceed with the interview?

I anticipate that the interview will take approximately 45 minutes. If you give your consent, I would like to begin.

Teacher interview questions

When evaluating the activities conducted in scientific inquiry-based instruction, what differences do you observe compared to your other lessons?

Probing questions:

In terms of planning

In terms of implementation and activities

In terms of the assessment process

In terms of the learning process

In terms of time management in your lesson

When considering your responsibilities in scientific inquiry-supported science lessons compared to your other lessons, do you notice any differences? If so, how?

Probing questions:

In terms of planning

In terms of implementation

In terms of assessment

In terms of the physical learning environment

In terms of student learning

Do you think your students' roles and responsibilities differ in scientific inquiry-supported science lessons compared to other lessons? If so, how?

Probing questions:
In terms of planning
In terms of implementation
In terms of assessment
In terms of the physical learning environment
In terms of student learning
Do you think the communication and interaction in a classroom where scientific inquiry is implemented differ from your other classrooms? Why?

Probing questions:
In terms of planning
In terms of implementation
In terms of assessment
In terms of the physical learning environment
In terms of student learning
What aspects of teaching science lessons with scientific inquiry did you enjoy or appreciate? Which features of scientific inquiry did you find particularly engaging? Why?

Probing questions:
In terms of planning
In terms of implementation
In terms of assessment
In terms of the physical learning environment
In terms of student learning
What aspects of teaching science lessons with scientific inquiry did you dislike? If you had the opportunity to make changes, what would you modify and why?

Probing questions:
In terms of planning
In terms of implementation
In terms of assessment
In terms of the physical learning environment
In terms of student learning
Do you think the development of students who participated in your scientific inquiry-supported lessons differs from that of students in your other classes? If so, how?

Probing questions:

In terms of cognitive development
In terms of thinking skills (critical thinking, creative thinking, problem-solving)
In terms of social aspects (engagement, interaction, responsibility-taking, collaboration)
In terms of affective aspects (motivation)
In terms of planning
In terms of implementation
In terms of assessment
In terms of the physical learning environment
In terms of student learning
As a teacher, what have you gained from this practice? How has implementing scientific inquiry influenced you professionally?

Probing questions:
In terms of planning
In terms of implementation
In terms of teaching competencies
In terms of assessment
In terms of the physical learning environment
In terms of student learning