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Nawal Fahhad Alotaibi[1]

Nouf Fahad ALZuhair[2*]

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[1]A secondary school physics teacher at the Ministry of Education in the Kingdom of Saudi Arabia
[2]Associate Professor, department of curriculum and instruction, Faculty of Education, Imam Mohammad Ibn Saud Islamic University (IMSIU)

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Nawal Fahhad Alotaibi[1],Nouf Fahad ALZuhair[2*]
[1]A secondary school physics teacher at the Ministry of Education in the Kingdom of Saudi Arabia
[2]Associate Professor, department of curriculum and instruction, Faculty of Education, Imam Mohammad Ibn Saud Islamic University (IMSIU)
*Corresponding Author
Email: nfh-22@hotmail.com[1],nfalzuhair@imamu.edu.sa[2]

ABSTRACT
The study aims to uncover the teaching practice level among secondary school physics teachers for the second grade in Riyadh. The study used a descriptive survey to attain its goal. The study item was a notecard, and the sample included 61 female public school Physics teachers. The results revealed a lack of physics teachers' teaching practices in second-grade secondary school for scientific inquiry characteristics such as scientific-oriented questions, formulating explanations from evidence, linking descriptions to scientific knowledge, and communicating and justifying explanations. Moreover, there were no statistically significant variations in physics teachers' teaching techniques based on years of experience, except for behaviors relating descriptions to scientific knowledge, favoring professors with 15 years or more of experience. Except for teaching practices linked to "communication and justification of explanations," there were statistically significant variations between physics teachers' teaching practices for variable training courses in scientific inquiry. As a result of these findings, the researcher proposes providing training and professional development programs for female instructors in scientific investigations and revising teacher preparation programs for male and female teachers.

Keywords: Inquiry - Inquiry practice - Teaching physics - Physics teachers - Second grade of secondary school

INTRODUCTION

Inquiry-based physics education is one of the latest trends in science education reform. The National Council for Scientific Research's National Science Education Standards (1966, NSES) emphasize inquiry in science learning and instruction for all grades. Inquiry-based learning helps students develop their personalities, creative talents, and scientific thinking. With the help of inquiry, students can gain a deeper comprehension of scientific phenomena, broaden their knowledge, and provide reliable scientific explanations. They aim to answer questions by study, data collection, and analysis and back up answers and interpretations with proof and evidence. Since inquiry needs steady and continual practice, children are gradually adapted from kindergarten through high school.

The Problem

Due to the quick changes in the information, it is vital to help the learner collect, interpret, and apply knowledge. For example, the American National Research Council (NRC) supports inquiry-based science teaching. NRC (2000, p20) states, "Learners must be integrated into inquiry-based science programs." It improves science learning by enhancing student-teacher interaction. Some items and tasks demand students to use knowledge, concepts, and skills in the science content and cognitive processes (Abdul Salam et al., 2007).
The McGraw-Hill Science Series has been translated and harmonized to reflect current trends. Original series based on US National Standards for Science Education (1996, NRC). They show the value of scientific inquiry in reaching scientific education and science teaching goals and developing various areas of the teaching-learning process (Al-Saadani, 2006; Owedah, 2007).
Teaching physics without handling concepts in a scientific-practical way that facilitates students' learning supports the necessity to reveal the practice level of scientific investigation (practice-level). So, the study aimed to assess second-year physics professors in Riyadh's teaching practices.

Research Questions

The study sought answers to the following main question:
What is the teaching practices level among the secondary school physics teachers for the second grade in light of the scientific inquiry characteristics in Riyadh city?

The following are the sub-questions:
(1) What is the teaching practices level among the secondary school physics teachers for the second grade in asking scientifically oriented questions?
(2) What are the second-grade secondary school physics teachers' teaching practices in identifying and collecting evidence to answer questions?
(3) What is the second-grade secondary school physics teachers' teaching practices level in formulating explanations from evidence?
(4) What is the second-grade secondary school physics teachers' teaching practices level in linking explanations to scientific knowledge?
(5) What are the second-grade secondary school physics teachers' teaching practices in communicating and justifying explanations?
(6) What are the statistical differences in the physics teachers teaching practices attributable to the number of experience years, qualifications, and training courses in the scientific inquiry field?

Significance of the Study

The study's significance originates from NRC teaching science guidelines (NRC, 1996). It is hoped that the study would help physics teachers stimulate scientific inquiry in male and female secondary school students. Based on the study's findings, educational supervisors should implement programs and training courses that foster scientific curiosity among secondary school students.

Limits of the Study

The study comprises forming explanations based on data, linking reasons to scientific knowledge, and communicating and justifying explanations. The study focused on girls' public secondary schools in Riyadh, Saudi Arabia. The second-semester students of the academic year 1441/1442 AH were part of the study. Physics teachers for the second grade of secondary school were part of the study.

Theoretical framework

Inquiry is a key concept in science education. It is widely used in science teaching (Zaytoun, 2010). Reconstructing scientific education aims to teach science through inquiry (Al-Shamrani, 2012). The inquiry is prominent in educational literature, especially in science education. Scientists examine nature and propose interpretations based on their findings. Scientists employ scientific inquiry to expand their knowledge and comprehension of ideas, such as the scientific method. So he defined scientific investigation as posing scientific questions, locating and compiling evidence, creating explanations based on evidence, relating explanations to scientific knowledge, and conveying and justifying explanations. According to the American National Standards, this might range from entirely open to the student to completely supervised by the teacher (NRC, 2000). The optimal level allows the pupil to practice these attributes freely.

Previous Studies

The study by Goni (2005) found that science instructors employ inquiry teaching insufficiently and that experience boosts utilization and application. Students' ability to explain natural phenomena scientifically improved. Marshall et al. (2007) discovered that the ideal length should be substantially longer than what is now practised.

Al-Dahmash and Al-Shamrani (2012) revealed that most science teachers spend 20% of class time on inquiry. The Saudi education system must be improved to suit the new science curricula. Al-Shamrani (2012) found that all practical activities featured "raising scientific-oriented inquiries."

Al-Mohi (2016) indicated that (44%) of teachers conduct practical exercises alone, denying students the opportunity to practice investigative skills, and (56%) allow students to practice investigative skills collectively at the lowest levels of skill practice. He discovered that the teacher's expertise with traditional teaching methods, the students' lack of scientific inquiry skills and data gathering and analysis, and the coursebook's denseness hindered his surveying science class. Weak laboratory reports and insufficient time to practice inquiry contribute to the teacher's burden. Teachers with 10 to 15 years of experience were the most aware of the challenges.

The purpose of this study is to improve science teachers' teaching approaches. Some researchers used different skills and classifications of scientific investigation, such as Al-Mohi (2015) and Al-Dahmash and Al-Shamrani (2012). Unlike earlier studies, Goni (2005) and Al-Mohi (2015) used achievement examinations, questionnaires, and content analysis cards. This study used an observation tool containing quantitative and qualitative data.

Research Methodology

An observational descriptive (survey) approach was utilized. The two researchers agreed that this strategy suited the current study's objectives. Identifying secondary school physics instructors' teaching practices for second grade and quantifying them to get findings that define the level of their practice through analysis and interpretation of the results.

The Population of the Study

The study population included all (120) female secondary school physics teachers for the second grade in Riyadh public schools for the academic year 1441/1442.

Study Sample

To identify the study sample characteristics, frequency and percentages were calculated according to the demographic variables represented: (kind of qualification, years of experience, and number of training courses), as shown in the Table 1.

Table 1:The Distribution of study sample members according to the qualification type

qualification type	Frequency	Ratio (%)
Educational	53	86.9
Non-educational	8	13.1
Total	61	100

(Source: collected from the notecard prepared by the two researchers)

It was shown in Table 1 that 86.9% of the sample have an educational qualification type, and 13.1% of them have a non-educational kind of qualification.

Table 2 :The Distribution of the study sample according to the experience years

The experience years	Frequency	Ratio (%)
Less than 5 years	-	-
From 5- less than 10 years	20	32.8
10 –less than 15 years	22	36.1
15 years and more	19	31.1
Total	61	100

(Source: collected from the notecard prepared by the two researchers)

Table 2 shows that 36.1% of the sample have experience between 10 to 15 years, 32.8% have 5 to 10 years of experience, and 31.1% have 15 years or more experience.

Table 3:The Distribution of the study sample according to the number of training courses

The number of training courses	Frequency	Ratio (%)
No courses	35	57.4
1-2 courses	16	26.2
3 courses and more	10	16.4
The total	61	100

(Source: collected from the notecard prepared by the two researchers)

Table 3 shows that 57.4% of the sample lacks scientific inquiry courses, 26.24% have 1 to 2 courses, and 16.4% have 3 or more courses.

Study Tool

A notecard was created as a measuring instrument. The notecard has two pieces. The first portion contains basic information such as name, qualification, years of experience, and training courses. The second portion assesses secondary school physics instructors' second-grade teaching techniques in light of Riyadh's scientific inquiry features.

(1) Identifying the notecard's purpose is to assess physics teachers' teaching techniques based on scientific investigation.
(2) Identifying the notecard's construction sources to assess the classroom's basic inquiry elements. The two researchers translated the Table from English to Arabic.
(3) First, the notecard had (19) indications split into five domains:
  - Domain 1: Scientific inquiry participation (4) signs

- Domain 2: Finding and gathering evidence for (4) indications.
- Domain 3: Building explanations from evidence: (4) signals
- Domain 4: scientific explanations: 3 indicators
- Domain 5: Communication and justification: four signals.

(4) The following choices are accessible on a rating scale (unavailable, weakly available, moderately available, highly available), with a grade from 1 to 4 for the appropriateness of applying statistical quantitative treatments.
(5) Making an instructive practice level key for the cards.
(6) Submit the tool to the arbitrators, experts in science curricula, and teaching methodologies.
(7) Its stability was evaluated from 7-14/8/1442 AH by a cooperating observer identical to the researcher in speciality and qualification (Bachelor of Physics) on a random sample of ten female teachers selected after training.

'$$\boldsymbol{The\ agreement\ ratio} = \frac{\boldsymbol{the\ agreement\ numbers}}{\boldsymbol{the\ agreement\ numbers+the\ disagreement\ numbers}} \times \mathbf{100}$$

Using this calculation, the average stability coefficient for this card was 87.4%, deemed high. Table 4 shows the percentage agreement values:

Table 4:Coefficients of Observers Agreement

No. of the observer teacher	Percentage of Agreement	No. of the observer teacher	Percentage of Agreement
1	72%	6	100%
2	77%	7	94%
3	95%	8	94%
4	94%	9	77%
5	88%	10	83%
Average		87.4	

(Source: collected from the notecard prepared by the two researchers)

The final image of the observation card includes (18) tasks distributed throughout five areas, namely:

- Domain 1: Participation in scientific questioning. 4 indications.
- Domain 2: Finding and collecting evidence to address the following questions: 3 indications
- Domain 3: constructing explanations from evidence: 4 indications.
- Domain 4: relating explanations to scientific knowledge: 3 indicators
- Domain 5: Interpretation communication and justification: 4 indicators

Study Procedures

The study followed these steps:

- Visits and coordination with education offices in Riyadh
- Field deployment of the research tool to a sample of (61) female teachers for two weeks during the second semester of the academic year 1441/1442 AH.
- Observing and documenting all sample members' performance on each characteristic
- Data unloading and analysis
- Presentation and interpretation of data, including comparison with past studies
- Make some suggestions.

Statistical Processing Methods

The data were analyzed statistically using the Statistical Package for Social Sciences (SPSS) application. The range was obtained by dividing the number of categories by the length of the scale categories utilized on the card.

Table 5:Rating categories to judge the results

Average	Available degree
3.36-4	High
2.51-3.35	Medium
1.76-2.50	Low
1-1.75	Unavailable

- Cooper's equation calculates the observers' agreement while measuring the observation card's stability.
- Frequency and percentages to describe study participants.
- Arithmetic means and standard deviations to see the replies' trends.
- The Mann-Whitney test for statistical differences.
- Kruskal-Wallis test to compare statistically.

The Study Results

The researcher used frequencies, percentages, arithmetic means, and standard deviations to determine the degree to which secondary school physics teachers in their second year of practice the characteristic of asking scientifically oriented questions. The researcher estimated the degree of availability of each indicator using the categories suggested in constructing the scale.

Table 6:Physics teachers practice and the participation aspect in asking scientific-oriented questions

NO	Item		Available degree				mean	St. Devi.	Order
			Large	Medium	Low	unavailable			
1	The teacher presents an inquiry question to communicate with students	q.	15	13	19	14	2.47	1.10	1
		%	24.6	21.3	31.1	23			
2	The teacher presents an inquiry question and the student reformulate it	q.	0	0	0	61	1	0	3 R
		%	0	0	0	100			
3	The teacher presents some inquiry questions, and the student chooses one or puts a new one	q.	0	0	0	61	1	0	3 R
		%	0	0	0	100			
4	The teacher allows the student to ask new inquiry questions	q.	0	0	1	60	1.02	0.128	2
		%	0	0	1.6	98.4			
The general mean = 1.37, The general Standard deviation = 0.273									

(Source: collected from the notecard prepared by the two researchers)

Table 6 shows that the sample members' participation in scientific-oriented questions is arranged as follows:

(1) Since the arithmetic mean (2.47) indicates low availability, the teacher offers the inquiry question to the student.

(2) The teacher enables fresh inquiry questions because the arithmetic mean is (1.02).

(3) The teacher rephrases the inquiry question. When the arithmetic mean is (1), it is impossible to ask a question.

(4) The general arithmetic mean of (1.37) shows that this feature's expressions are unavailable.

The Second Research Question

To determine the frequency, percentages, arithmetic means, and standard deviations of this feature, as given in Table 7

Table 7:Physics teachers practice identifying and collecting evidence to answer questions

NO	Item		Available degree				mean	St. Dev i.	Order
			Large	Medium	Low	Unavailable			
1	The teacher presents data for analyzing it to answer the asked question	q.	14	14	19	14	2.45	1.08	1
		%	23	23	31	32			
2	The teacher directs the student to collect scientific evidence and specific data to answer the questions.	q.	9	2	9	41	1.65	1.09	2
		%	14.8	3.2	14.8	67.2			
3	The teacher allows the student to form the evidence and collect it.	q.	6	3	0	52	1.39	0.97 0	3
		%	9.8	4.9	0	85.3			
The general mean = 1.83, The general Standard deviation = 0.928									

(Source: collected from the notecard prepared by the two researchers)

Table 7 shows that the expressions for recognizing and gathering evidence to answer the sample members' queries are arranged in the following order:

(1) The teacher gives the student data to analyze to answer questions where the arithmetic mean was (2.45), indicating low availability.
(2) The teacher instructs the student to obtain scientific facts and data to answer questions where the arithmetic mean (1.65) is unavailable.
(3) Because the arithmetic mean is (1.39), the teacher lets the student create the evidence and collect it.
(4) The general arithmetic mean of (1.83) shows that the expressions of this characteristic are weakly available.

The Third Research Question

This question concerns the practice degree of secondary school physics teachers generating explanations from evidence.

Table 8 The trait's frequencies, percentages, arithmetic means, and standard deviations

NO	Item		Available degree				mean	St. Dev i.	Order
			Large	Medium	Low	unavailable			
1	The teacher presents the scientific evidence to the student and introduces her to how to use it in formulating the interpretation.	q.	13	11	20	17	2.32	1.10	1
		%	21.3	18	32.8	27.9			
2	The teacher introduces the student to possible ways to use scientific evidence in formulating scientific explanations.	q.	4	6	9	42	1.54	0.92 3	2
		%	6.6	9.8	14.8	68.8			
3	The teacher guides the student on how to formulate explanations from scientific evidence.	q.	6	3	8	44	1.52	0.97 6	3
		%	9.8	4.9	13.1	72.2			
4	The teacher allows the student to formulate explanations according to the scientific evidence she has collected.	q.	6	3	0	52	1.39	0.97 00	4
		%	9.8	4	0	85.3			
The general mean = 1.69, The general Standard deviation = 0.880									

Table 8 shows the trait's frequencies, percentages, arithmetic means, and standard deviations:

(1) Arithmetic mean (1.52) is not available. The teacher guides students to generate explanations from scientific data.
(2) The teacher invites students to construct judgments based on scientific facts without arithmetic.
(3) The overall arithmetic mean of (1.69) indicates no expressions exist for this feature.

The Fourth Research Question

The frequencies, percentages, arithmetic means, and standard deviations of this feature were determined, as given in Table 9:

Table 9:Physics teachers practice the feature of linking explanations to scientific knowledge

NO	Item		Available degree				mean	St. Devi.	Order
			Large	Medium	Low	unavailable			
1	The teacher presents the student with what is likely related to the explanations.	q.	6	2	11	42	1.54	0.958	2
		%	9.8	3.3	18	68.9			
2	The teacher directs the student to areas and sources of scientific knowledge	q.	6	10	19	26	1.93	0.997	1
		%	9.8	16.4	31.4	42.6			
3	The teacher allows the student to independently examine other sources of scientific knowledge to form connections between them and explanations.	q.	1	3	3	54	1.19	0.600	3
		%	1.6	4.9	4.9	88.6			
The general mean = 1.55, The general Standard deviation = 0.724									

(Source: collected from the notecard prepared by the two researchers)

Table 9 shows that the terms tying the explanations to the sample members' scientific knowledge are grouped as follows:
(1) The female teacher refers the student to scientific disciplines and sources, where the arithmetic mean was (1.93) indicating poor availability.
(2) The teacher shows the student the missing arithmetic mean (1.54) in the interpretations.
(3) The teacher allows the student to independently investigate different scientific sources to build relationships between them and the missing arithmetic mean (1.19)
(4) The overall arithmetic mean of (1.55) indicates that no expressions exist for this feature.

The Fifth Research Question:

Answering the fifth research question, the frequency, percentages, arithmetic means, and standard deviations of this attribute are given in Table 10:

Table 10:The degree to which female physics teachers practice communicating and justifying explanations

NO	Item		Available degree				Mean	St. Devi.	Order
			Large	Medium	Low	unavailable			
1	The teacher provides the student detailed steps and procedures for communicating with others.	Z	9	6	20	26	1.96	1.06	1
		%	14.8	9.8	32.8	42.6			
2	The teacher gives the student directions to improve her communication.	q.	12	6	11	32	1.96	1.19	2
		%	19.7	9.8	18	52.5			
3	The teacher trains the student to develop scientific communication.	q.	2	6	6	47	1.39	0.801	3
		%	3.4	9.8	9.8	77			
4	The teacher allows the student to form a logical, justified dialogue to communicate the explanations.	q.	1	4	9	47	1.32	0.676	4
		%	1.6	6.6	14.8	77			
The general mean = 1.66, The general Standard deviation = 0.815									

(Source: collected from the notecard prepared by the two researchers)
The tables show that:
(1) The student's arithmetic average was (1.96), indicating low availability.
(2) The teacher instructs students to improve communication, where the arithmetic mean was (1.96), indicating low availability.
(3) The student and teacher are trained to reach (1.39) to promote scientific communication, which is unavailable.
(4) Without an arithmetic mean (1.32), a teacher invites students to develop logical dialogues regarding the explanations.
(5) The overall arithmetic mean of (1.66) indicates that no expressions exist for this feature.

The Main Research Question

The researcher measured the availability degree of each indication using arithmetic means and standard deviations. Table 11 summarises the results based on the observation card categories and the overall average for each trait for all (61) visits, one per teacher.

Table 11The practice level of the scientific inquiry characteristics by the secondary school female physics teachers for the second grade

Order	The scientific inquiry characteristics	Arithmetic mean	standard deviation	the availability degree
1	Participate in asking scientifically oriented questions	1.37	0.272	Unavailable
2	Identify and gather evidence to answer questions	1.83	0.928	Low
3	Formulating explanations from evidence	1.69	0.880	Unavailable
4	Linking explanations to scientific knowledge	1.55	0.724	Unavailable
5	Communicate and justify explanations	1.66	0.815	Unavailable
Overall characteristics of a scientific inquiry		1.62	9.724	Unavailable

(Source: collected from the notecard prepared by the two researchers)

Table 11 shows that female secondary school physics instructors do not engage in scientific research. The arithmetic mean for all variables was (1.62) out of (4), with a standard deviation of (0.724), indicating convergence of female instructors' teaching practices level.

The Sixth Research Question

The Kruskal-Wallis test was used to find differences in the teaching practices of female physics teachers in light of the scientific inquiry characteristics attributed to the variable type of qualification, as described below:

First: Qualification Type Variable

Table 12 :The Mann-Whitney test and the differences between the answers of the sample members according to the qualification type variable

Dimension	**qualification type**	**Number**	**Rank mean**	**Total rank**	**Mann-Whitney coefficient**	**Statistical significance**
Participate in asking scientifically oriented questions	educational	53	34	1802	53	0.000*
	non-educational	8	11.13	89		
Identify and gather evidence to answer questions	educational	53	33.98	1801	54	0.001*
	non-educational	8	11.25	90		
Formulating explanations from evidence	educational	53	32.72	1787	68	0.002*
	non-educational	8	13	104		
Linking explanations to scientific knowledge	educational	53	32.97	1747.50	107.50	0.021*
	non-educational	8	17.14	143.50		
Communicate and justify explanations	educational	53	33.1	1755	100	0.014*
	non-educational	**8**	**17**	**126**		

(*) significant at 0.05 (Source: collected from the notecard prepared by the two researchers)

Table 12 shows:

(1) The Mann-Whitney coefficient (53), which is less than 0.05, shows statistically significant differences in the sample members' replies to participating in scientifically focused queries (0.05).
(2) The Mann-Whitney coefficient (54), and the level of significance (0.001), are statistically significant variations between the sample members' responses concerning recognizing and collecting evidence to answer the questions (0.05).
(3) The Mann-Whitney coefficient (68) obtained statistical significance among the sample members' responses about developing explanations from the data favouring the educational qualification type (0.05).
(4) There are statistically significant variations between the sample members' replies about linking explanations to scientific knowledge, with the Mann-Whitney coefficient (107.50) reaching statistical significance (0.021). (0.05).
(5) The Mann-Whitney coefficient (100) indicates statistically significant variations in the sample members' responses about communication and justification of explanations for the educational qualification type (0.05).
(6) Educated female instructors, unlike non-educated female teachers, engage in scientific study.

Second: Experience Years Variable

Table 13:The Kruskal-Wallis test shows the statistical differences between the sample members' responses according to the number of experience years variable

Dimension	experience years	Number	Rank mean	Total rank	Mann-Whitney coefficient	Statistical significance
Participate in asking scientifically oriented questions	5- Less than 10 years	20	27.95	1.04	2	0.594*
	From 10- less than 15 years	22	31.70			
	more than 15 years	19	33.39			
Identify and gather evidence to answer questions	5- Less than 10 years	20	31.13	2.05	2	0.358*
	From 10- less than 15 years	22	27.32			
	more than 15 years	19	35.13			
Formulating explanations from evidence	5- Less than 10 years	20	27.65	2.60	2	0.002*
	From 10- less than 15 years	22	29.55			
	more than 15 years	19	36.21			
Linking explanations to scientific knowledge	5- Less than 10 years	20	27.58	7.50	2	0.023*
	From 10- less than 15 years	22	26.43			
	more than 15 years	19	39.89			
Communicate and justify explanations	5- Less than 10 years	20	29.58	0.982	2	0.612*
	From 10- less than 15 years	22	29.48			
	more than 15 years	19	34.26			

(*) significant at the 0.05 level (source: collected from the observation card prepared by the two researchers)

Table 13 shows:

(1) There are no statistically significant differences among the sample members' responses about participating in asking scientific-oriented questions where the K-square coefficient reached (1.04) at the degree of freedom (2) and the level of significance (0.594), which is greater than (0.05).

(2) There are no statistically significant differences among the sample members' responses about identifying and collecting evidence to answer the questions where the K-square coefficient reached (2.05) at the degree of freedom (2) and the level of significance (0.358), which is greater than (0.05).

(3) There are no statistically significant differences among the sample members' responses about the formulation of interpretations from the evidence where the K-square coefficient reached (2.60) at the degree of freedom (2) and the level of significance (0.272), which is greater than (0.05).

(4) There are statistically significant differences among the sample members' responses about linking explanations to scientific knowledge, where the K-square coefficient reached (7.50) at the degree of freedom (2). The significance level is (0.023) less than (0.05). To know the source of these differences, The Mann-Whitney test was conducted. It became clear that there are statistically significant differences between those with experience years from 5 to less than 10 years, and those with experience years of 15 years or more, in favor of those with experience years of 15 years or more. There are statistically significant differences between those with 10 experience years, less than 15 years, and those with 15 years or more, in favor of those with 15 years or more, and Table 14 shows this.

Table 14:The Mann-Whitney test to show the differences between the sample members' responses according to the variable number of experience years

Dimension	experience years number	Rank mean	Total rank	Mann-Whitney coefficient	Statistical significance
Linking explanations to scientific knowledge	5- Less than 10 years	22.23	446.50	203.50	0.657*
	From 10- less than 15 years	20.75	456.50		
	5- Less than 10 years	15.75	315	105	0.016*
	15-more than 15 years	24.74	465		
	From 10- less than 15 years	17.18	378	125	0.023*
	15-more than 15 years	25.42	483		

(*) significant at the 0.05 level (source: collected from the observation card prepared by the two researchers)
The Table shows that the K-square coefficient achieved (0.982) at the degree of freedom (2) and level of significance (0.612), which is greater than 0. (0.05). More experienced female teachers "connect explanations with scientific knowledge."

Third: Number of Training Courses Variable

Table 15:The Kruskal-Wallis test shows the statistical differences among the sample members' responses according to the training courses variable number in the field of scientific inquiry

Dimension	Number of courses	Number	Rank mean	Total rank	Mann-Whitney coefficient	Statistical significance
Participate in asking scientifically oriented questions	No courses	35	25.03	11.18	2	0.004*
	From 1-2 courses	16	36.13			
	more than 2 courses	10	43.70			
Identify and gather evidence to answer questions	No courses	35	26.20	7.25	2	0.027*
	From 1-2 courses	16	34.75			
	more than 2 courses	10	41.80			
Formulating explanations from evidence	No courses	35	25.64	7.96	2	0.019*
	From 1-2 courses	16	37.09			
	more than 2 courses	10	40			
Linking explanations to scientific knowledge	No courses	35	24.31	12.54	2	0.002*
	From 1-2 courses	16	39.75			
	more than 15 years	10	40.40			
Communicate and justify explanations	No courses	35	27.17	4.39	2	0.111*
	From 1-2 courses	16	37.78			
	more than 2 courses	10	33.55			

(*) significant at the 0.05 level (source: collected from the observation card prepared by the two researchers)
Table 15 shows:
There are statistically significant differences among the sample members' responses about participation in asking scientific-oriented questions where the K-square coefficient reached (11.18) at the degree of freedom (2) and the level of significance (0.004) that is less than (0.05). We conducted the Mann-Whitney test to know the source of these differences. It became clear that there were statistically significant differences between those

who had no training courses and those who had 1-2 courses. It became clear that there are significant differences.

Table 16:The Mann-Whitney test to show the differences between the sample members' responses according to the number of training courses variable in the scientific inquiry field

Dimension	Number of courses	Rank mean	Total rank	Mann-Whitney coefficient	Statistical significance
Participate in asking scientifically oriented questions	No courses	23.01	805.50	175.50	0.027*
	From 1-2 courses	32.53	520.50		
	No courses	20.01	700.50	70.50	0.003*
	3 and more courses	33.45	334.50		
	From 1-2 courses	12,09	193.50	57.50	0.210
	3 and more courses	15.75	157.50		

(*) significant at the 0.05 level (source: collected from the observation card prepared by the two researchers)

The Table shows that the K-square coefficient achieved (7.25) at the degree of freedom (2) and level of significance (0.027), which is less than 0.05. The Mann-Whitney test revealed statistically significant differences between those who had no courses and those who had 3 or more courses, as shown in Table 17.

Table 17:The Mann-Whitney test to show the differences among the sample members' responses according to the number of training courses variable in the field of scientific inquiry

Dimension	Number of courses	Rank mean	Total rank	Mann-Whitney coefficient	Statistical significance
Participate in asking scientifically oriented ques Identify and gather evidence to answer questions	No courses	23.63	827	197	0.083*
	From 1-2 courses	31.19	499		
	No courses	20.75	720	90	0.019*
	3 and more courses	31.50	315		
	From 1-2 courses	12,06	193	57	0.241
	3 and more courses	15.80	158		

(*) significant at the 0.05 level (source: collected from the observation card prepared by the two researchers)

It is evident from Table 17 that:

There are statistically significant differences among the sample members' responses about the formulation of explanations from the evidence where the K-square coefficient reached (7.96) at the degree of freedom (2) and the level of significance (0.019) that is less than (0.05). The Mann-Whitney test was conducted to know the source of these differences. It became clear that there were statistically significant differences between those who had no courses and those who had from 1 - 2 courses, in favor of 1 - 2 courses. It became clear that there are significant differences with statistical significance between those who had no courses and those who had 3 or more, in favor of 3 or more, and Table 18 shows this:

Table 18:The Mann-Whitney test to show the differences between the sample members' responses according to the number of training courses variable in the scientific inquiry field

Dimension	Number of courses	Rank mean	Total rank	Mann-Whitney coefficient	Statistical significance
Formulating explanations from evidence	No courses	22.80	798	168	0.019*
	From 1-2 courses	33	528		
	No courses	20.84	729.50	99.50	0.038*
	3 and more courses	30.55	305.50		
	From 1-2 courses	12,59	201.50	65.50	0.452
	3 and more courses	**14.94**	**149.50**		

(*) significant at the 0.05 level (source: collected from the observation card prepared by the two researchers)

The K-square coefficient achieved (7.50) at the degree of freedom (2) and level of significance (0.023) that is less than 0.05. (0.05). The Mann-Whitney test revealed statistically significant differences between those who had no courses and those who had 1 - 2 courses, favoring those who had 1 - 2 courses, and significant statistical differences between those who had no courses and those who had 3 or more courses, favoring those who had 3 or more, as shown in Table 19:

Table 19:The Mann-Whitney test to show the differences between the answers of the sample members according to the number of training courses variable in the scientific inquiry field

Dimension	Number of courses	Rank mean	Total rank	Mann-Whitney coefficient	Statistical significance
Linking explanations to scientific knowledge	No courses	22.03	771	141	0.003*
	From 1-2 courses	34.69	555		
	No courses	20.96	710	80	0.008*
	3 and more courses	32.50	325		
	From 1-2 courses	12,56	217	79	0.979
	3 and more courses	13.40	134		

(*) significant at the 0.05 level (source: collected from the observation card prepared by the two researchers)

Table 19 shows that there are no statistically significant differences in the sample members' replies on communication and explanation justification, where the K-square coefficient reached (4.39) at the degree of freedom (2) and level of significance (0.111). (0.05).

Discussion and interpretation of the results

The results show that secondary school physics teachers do not teach physics via scientific inquiry for numerous reasons. There is a lack of time for scientific investigation due to the depth study of the scientific material in the second grade of secondary school.

The results suggest that female teachers' practice of asking scientifically oriented questions falls on the first scientific research level. The female teacher presents the investigation question to the student. The study (Al-Shamrani, 2012) demonstrated the presence of "asking scientific-oriented questions" in the activities of the physics book for the second grade of secondary school. Women's teachers' students' participation was partially through providing data for analysis, which may be due to the focus on performing the task to ensure class time.

Female teachers' use of scientific evidence to formulate explanations for female students falls within the first level of scientific inquiry to a weak degree, allowing only partial and specific student participation. This may be attributed to the teachers' lack of confidence in their students' exploration ability.

In the first level of scientific inquiry, the teacher provides the student with direct access to scientific knowledge fields and sources. The feature of "linking explanations with scientific knowledge" was not available. The practice occurred weakly due to a lack of time allocated for the inquiry.

In the first and second stages of scientific inquiry, female instructors' practice of "communication and justification of explanations" was weak. The teacher's goal is to keep the classroom quiet and save time to prevent discussion, replies, and justification. Lesson time constraints and low student achievement in physics may cause teachers to be reluctant to practice and offer new ideas.

These findings support Al Mohi's (2015) study, which found that teachers' instructional techniques do not allow pupils to engage in scientific inquiry. Science teachers do not allow students to ask scientific questions. Also, many scientific professors conduct practical activities such as demonstrations. Al-Dahmash and Al-Shamrani, (2012) demonstrated the insufficiency of physics teachers' instructional approaches to scientific inquiry.

The results show statistically significant disparities in all teaching techniques favoring female teachers with educational degrees. This means qualified female professors conduct scientific research but do not address modern teaching methods for science curricula.

The results also demonstrated no statistically significant differences in scientific inquiry qualities for all teaching approaches, except for "linking explanations with scientific knowledge," favoring female teachers with 15 years or more experience. This is due to years teaching various scientific topics at different academic levels. This finding is in line with those (Goni, 2005) who discovered that experienced science teachers employ and apply the steps of inquiry teaching conduct more.

The results show statistically significant variations in teaching methods for female professors with three or more courses, except for the feature "communication and justification of explanations." Because female teachers' practice of inquiry was at the weakest levels, it confirms the need to identify female physics teachers' actual and realistic training needs. According to Al Mohi (2015), 46% of science teachers did not acquire scientific inquiry training, compared to 57% in our survey. This necessitates specialized professional development programs.

Study Recommendations:

The study recommends the following:

(1) The Ministry of Education should train female instructors in scientific inquiry and provide them with ways that promote scientific inquiry and research in physics.

(2) The ministry should activate teaching approaches based on scientific inquiry features. Providing suitable support to improve future performance is among the benefits of this study's notecard for male and female physics supervisors.

(3) The need to rethink the plans for preparing male and female teachers for university general education stages is necessary, where the survey is a major component, through courses within the preparation program.

(4) Experienced female teachers should provide excellent lessons and strengthen professional learning communities.

Future Study Suggestions

Based on the findings, the researcher recommends the following studies:

(1) Primary science teachers' teaching techniques are based on scientific inquiry characteristics.

(2) Intermediate science instructors' teaching strategies in light of scientific inquiry characteristics.

(3) The efficacy of a physics teacher t

(4) raining program to create scientific inquiry teaching approaches.

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