Research Article

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Effectiveness of a Proposed Training Program to Develop Action Research Skills Among Female Mathematics and Science Teachers in Bisha

Ibrahim Alhussain Khalil[1]

Amira Saad Al-Zahrani[2]

Rania Mohamed Ahmed[3]

[1]*Assistant Professor of Mathematics Education,*
Department of Curriculum and Teaching Methods,
College of Education, University of Bisha,
Bisha 61922, P.O. Box 551, Saudi Arabia
[2]*Assistant Professor of Curriculum and Teaching Methods of Science,*
Department of Curriculum and Teaching Methods, College of Education,
University of Bisha, Bisha 61922, P.O. Box 551, Saudi Arabia
[3]*Assistant Professor of Educational Psychology,*
Department of Educational Psychology,
College of Education, University of Bisha, Bisha 61922,
P.O. Box 551, Saudi Arabia

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Abstract

The study aimed to identify the effectiveness of a proposed training program for developing action research skills among female mathematics and science teachers in the Kingdom of Saudi Arabia. The study employed a semi-experimental approach with a one-group design and pre- and post-measurement. A sample of 36 female mathematics and science teachers from the Bisha Education Department took part in the training program and then took a test to evaluate their action research skills. The results revealed statistically significant differences in the teachers' action research skills at the level $\alpha \leq 0.05$ between the pre- and post-measurements in favor of the latter. In light of the study results, some recommendations can be made: A culture of action research should be fostered among male and female teachers in general and in mathematics and science teaching specifically; research partnerships should be built to include experts and male and female teachers in general education; male and female teachers should undergo training to develop action research skills.

Keywords: *training program, mathematics and science, female teachers, action research skills*

1. Introduction

Countries depend on scientific research as a basis for developing their societies in general and their educational provision in particular. This calls for the cultivation of a culture of scientific research among male and female teachers through engaging them in action research, which is one of the best

means of solving problems in the field. Empowering teachers with action research skills is important so that they can fully exploit classroom activities to benefit their students (Hassen, 2016). In the 21st century, teachers need to keep abreast of developments in pedagogy and their subject and develop their practice in line with the requirements of the times. They need to be able to contribute to the development of the educational process as a whole, as it is considered one of the most important inputs and is a driving force for school reform. The Ministry of Education in the Kingdom of Saudi Arabia has made spreading a culture of scientific research and improving its quality a key focus as one of the goals of the Saudi Vision 2030, a strategic framework for the country's development. This is viewed as one of the most effective means of enhancing teachers' self-development and solving problems in their practice.

Action research combines theory and application. In undertaking such research, individuals and institutions employ surveys and flexible scientific procedures to solve the real-world problems facing them (Khalil, 2022). It is a type of research common in education and involves those engaged in the educational process, such as teachers, administrators, and supervisors, working to improve their practice and raise their professional performance by examining their educational practices and finding appropriate solutions to the problems they face (Al-Balawi, 2021). "Action" denotes procedure or doing, which includes operations or interventions that take place within a specific social context, such as educational institutions or classrooms, intending to develop them, and "Research" includes organized observation, data collection, analysis of changes and problems, scientific interventions, and then further actions based on the results (Burns, 2022).

The significance of action research lies in teachers studying the real problems and challenges that face them within their own educational environments and then selecting appropriate strategies for that environment (Lesha, 2014). Thus, it helps teachers verify the teaching methods they use and forms a professional identity that involves reflecting on and changing teaching practices. This approach fosters self-critique and develops professional competence, enhancing teachers' ability to experiment with new creative ideas, increasing their motivation, strengthening their confidence in the educational decisions they take, and giving them the opportunity for research and investigation (Hassen, 2016). The action research process comprises four stages: planning, action, observation, and reflection (Tsou, 2022). More specifically, according to Tirol et al. (2022), the basic components of action research are the following: defining the problem, developing an action plan, collecting, analyzing, and presenting data, observing research ethics, and thinking about the results.

Given the importance of action research for educational development and improvement, which enables experimentation related to school practices, directed toward improving them, and activates the role of researcher teachers, which leads to improved professional performance, studies have addressed action research from various angles. Al-Muzaini and Al-Mazroua (2012) investigated the effectiveness of a proposed training program for developing action research skills in science education among female in-service science teachers. They used a one-group experimental design with pre- and post-tests. Their results revealed statistically significant differences between the mean scores of science teachers (n = 16) in the pre-application and their mean scores in the post-application on all dimensions of the test (the concept of procedural research, thinking, skill planning) and the overall test scores, thus demonstrating the effectiveness of the program. In light of these results, the study made several recommendations, one being to develop action research skills among female teachers in other disciplines. Vaughan and Burnaford (2016) examined the importance of action research in teacher preparation programs and explored the goals, challenges, and effects of action research in preparing teachers before service. Their focus of interest was on preparation of teachers for the period 2000–2015 in the United States of America. The results of the study showed the importance of action research as a means of preparing teacher leaders, and highlighted three objectives of action research in pre-service teacher training, i.e., achieving participation, developing critical thinking, and enhancing problem-solving skills. Abu Sharar (2016) sought to determine the effectiveness of a training program based on action research in developing teachers' styles of teaching English language skills. The study concluded that action research had a significant effect on improving the teaching

skills of the English language teachers and increased their ability to apply action research.

Various studies have examined teachers' perceptions of the importance of action research and the potential obstacles to its implementation. Ash-Shanbari (2016) designed and implemented a training program to develop action research skills among middle-school science teachers (n = 11), using the analytical descriptive approach in addition to a one-group experimental design and pre- and post-tests. The program had a significant impact, demonstrating its effectiveness in achieving its objectives. Al-Otaibi (2016) examined the effectiveness of a training program designed to develop action research skills among female pre-service teachers at Princess Noura Bint Abdul Rahman University using a semi-experimental design. She developed a proposed training program and an achievement test to measure knowledge of action research skills and also designed an observation card to evaluate the performance of the study sample (39 student teachers). The results showed the effectiveness of the program based on statistically significant differences between the pre- and post-test means for the cognitive and skills aspects of action research in favor of the post-test. Long and Bae (2018) studied the perceptions of new science teachers in Singapore regarding scientific research and the challenges they faced in implementing lessons based on research and investigation. They recorded a video clip of a lesson for each of the science teachers participating in the study and conducted interviews. The results reveal that there are main factors influence science teachers` pedagogy practices, most notably, the lack of resources and time devoted to planning scientific research lessons. Al-Balawi (2021) examined the extent of existing action research skills among 120 female general education teachers in the city of Tabuk in the Kingdom of Saudi Arabia. The study found the teachers had varying degrees of skills, from low to medium, the most prevalent skills being visualizing and analyzing the problem. The primary study recommendation was to address the need to train female teachers to conduct action research.

Several studies have sought to develop action research skills. For example, Al-Arfaj (2020) aimed to build a training program to develop action research skills among teachers of classes of gifted students. The study employed a descriptive approach to identify the needs of the male and female teachers in an initial step and then develop a training program to develop their action research skills. The researcher interviewed the head of the gifted department in the Sabya Education Department and administered a questionnaire to a sample of teachers (24 male and 18 female). The results showed a need for a training program to develop an understanding of the concept of action research and research skills. In light of this, the researcher developed the general outline of a training program according to criteria of an integrated matrix for the objectives of MIT to build training curricula.

Al-Ruwais et al. (2021) aimed to identify the mathematics teachers' actual practice of action research in the middle school stage, their attitudes towards it, and the obstacles that hindered them from engaging in it. They administered a questionnaire, after confirming its validity and reliability, to a random sample of 130 mathematics teachers in the middle school stage, and then undertook follow-up interviews with 25 of the questionnaire participants. The results showed that the teachers believed in the importance of action research to improve their classroom practices and viewed it as a means for professional development and improving their teaching. However, the practice of action research had declined in mathematics classes, despite the teachers recognizing its importance, and the majority of teachers reported never having conducted action research individually or participated in it with others. One of the greatest obstacles was the scarcity of teacher training programs concerning the practice of action research.

2. Study Problem

Interest in scientific research is the basis for developing education and action research is one of the paths of professional development that enable teachers to improve their performance. This study was initiated based on the need for teachers to undergo training in action research to ensure their skills are commensurate with approved standards identified by the principal researcher as a reviewer of action research papers in several conferences and action research competitions. The researchers

conducted a pilot study with 20 teachers and supervisors to identify training needs. The majority (90%) of the study sample reported that action research was important to them, and identified their need to know the scope and steps in action research, as well as for programs that would help them develop their skills. This is consistent with the results of Al- Malky and Al- Ahmady (2022), Al-Balawi's (2021), Al-Ruwais et al.'s (2020), and Al-Adim (2013) studies, which conducted in Saudi Arabia. These studies showed that there were weaknesses in the skills of action research among teachers and their needs to training. Moreover, Al-Ghatami et al. (2018) analyzed a sample of research conducted by a group of teachers in general education and found that it did not conform to the specifications and methodology of action research to a great extent.

The importance of training teachers to conduct action research is evident in the recommendations made by Abdel-Hamid (2018). He argued that teachers need the opportunity to develop the ability to adapt and improve their teaching independently by learning to identify and solve pedagogical problems in a scientific manner. Hence, they need to be able to define the problem, develop and implement a research plan, propose scientific solutions, and then implement and evaluate these solutions. This process would increase teachers' self-confidence and self-esteem as teacher researchers and thinkers with the ability to make decisions.

Action research is perhaps even more crucial to address the problems and challenges faced by science and mathematics teachers in the classroom given the complexity of the field and the difficulties students face in studying science and mathematics. Teachers need to employ particular strategies to address these problems and difficulties. Hence, this study aimed to address the issue and answer the call from researchers such as As-Sayed and Abu Assi (2020), Abu Ali and Al-Tarawnah (2020), and Al-Ghatami et al. (2018) to design and organize training programs for in-service teachers on action research skills. In light of the foregoing arguments, the study set out to design a training program for female mathematics and science teachers in Bisha and verify its effectiveness.

3. The study

The study sought to answer the question "What is the effectiveness of a proposed training program for developing action research skills among mathematics and science teachers in Bisha?" by testing the following hypothesis:

There is no statistically significant difference at the significance level of $\alpha \leq 0.05$ between the mean scores of mathematics and science teachers in the primary school stage in the skills of action research before and after applying the proposed training program.

The significance of the study lies in the following:

1. Contributing to achieving the goals of the Kingdom of Saudi Arabia's Vision 2030, which aims to raise the country's level of global competitiveness.
2. Designing a training program to develop action research skills that can benefit those involved in professional development programs for teachers.
3. Developing a test to measure action research skills.

4. Methodology and Procedures

4.1 Study methodology

The study adopted a one-group semi-experimental design, using pre- and post-measurement to identify the effectiveness of the proposed training program (the independent variable) in developing the action research skills of female mathematics teachers based on the results of the action research skills test. Figure 1 shows the study design:

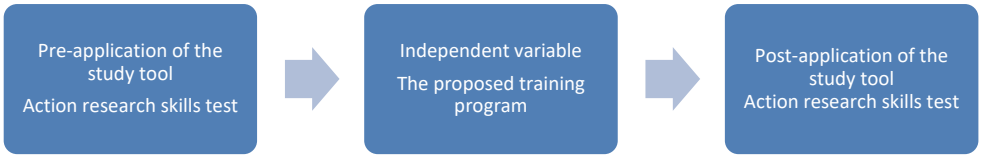

Figure 1: Study design

4.2 Study population and sample

The study population comprised all 428 female mathematics and science teachers in the Bisha Education Department in the academic year 2022. Of this total number, 36 female mathematics and science teachers from schools affiliated with the Education Department of Bisha took part. They expressed their wish to join the training program for developing action research skills after it was announced by the Training Unit of the Education Department.

4.3 Materials and method

4.3.1 Proposed training program

The process of designing the proposed training program comprised several stages

1. Analysis: The current state was analyzed by identifying the needs of female mathematics and science teachers through interviews and a survey.
2. Design: Following the analysis, the researchers designed the initial form of the training program, which included the following aspects:
   A. Objective: The program aimed to develop the action research skills of female mathematics and science teachers, i.e., realizing and defining the problem, reviewing the educational literature and formulating research hypotheses, preparing and codifying research tools, defining the research methodology, interpreting the results, and documenting references.
   B. Foundations and principles of the proposed training program: The program was based on the philosophy and concept of scientific research as the starting point for action research, and it was built on the following foundations:
      - The requirements of the Kingdom of Saudi Arabia's Vision 2030, which aims to attain excellence in scientific research and innovation.
      - Involving female teachers in solving and improving the educational environment.
      - Empowering female teachers with the basic skills of action research.
   C. Sources: Various sources contributed to building the program, most notably scientific bodies and organizations that are concerned with action research, and the educational literature and previous studies that have focused on action research in general and those specializing in mathematics and science in particular.
   D. Content: The program included many topics, primarily: the concept of scientific research, action research (concept, importance, assumptions, types, etc.), elements of procedural research, and writing up action research.
   E. Training Methods: The program included various training methods to ensure it fulfilled its function, including recitation, collaborative group work, electronic discussion, and self-learning.
   F. Activities: The training sessions included several individual and collective activities addressing the steps in action research, the writing elements of action research, how to write references, etc.

3. Development: The researchers presented the training program to a group of experts in the field of mathematics and science education and those interested in action research, and also in several meetings to a group of male and female supervisors and teachers. Their views on the program were taken into consideration. Finally, the National Center for Educational Professional Development in the Kingdom of Saudi Arabia provided accreditation for the program.
4. Implementation: The entire process took 6 days, with the pre-test on the first day and the post-test on the last. The training program comprised 12 sessions administered over 4 days (3 sessions per day), and each session lasted 60 minutes. Table 1 shows the content distribution over the training days.

Table 1: Distribution of the content and topics of the training program on the six training days

Day	1	2	3	4	5	6
First training session		Scientific research and its types	Importance and objectives of action research	Writing the elements of action research (aims, hypotheses, importance)	Writing the elements of action research (samples, tools)	
Second training session	Pre-test of action research skills	Characteristics of scientific research	Relation of action research with teachers' professional development	Writing the elements of action research (educational literature, previous studies)	Writing the elements of action research (analysis and explanation of results)	Post-test of action research skills
Third training session		The concept of action research	Writing the elements of action research (introduction, the problem)	Writing the elements of action research (tools, research methodology)	Writing the elements of action research (recommendations and suggestions, reference documentation)	

Evaluation: The training program included several stages of evaluation, namely:

A. Pre-evaluation: The initial evaluation established the training needs of the female mathematics and science teachers, and applied the pre-test to measure the existing level of their action research skills before implementing the training program.
B. Formative evaluation: In all training sessions, the researchers evaluated the discussions between the trainees and their performance in the activities, whether as individuals or in groups, as well as the tasks included in the working papers.
C. Final evaluation: This included the following:
   - Applying the post-test to measure the level of the teachers' action research skills following the program.
   - Undertaking program evaluation by holding discussions with the female trainees and supervisors, addressing the implications of the program and its effects, and its strengths and shortcomings.

4.3.2 Test of action research skills

Aim: The test aimed to measure the mathematics and science teachers' action research skills, which were divided into five categories: realizing and identifying the problem, reviewing educational literature and formulating research hypotheses, preparing and codifying research tools, defining research methodology, interpreting results, and documenting references.

Initial form: The initial form of the test consisted of four situations designed to reflect realistic research issues as a tool for measuring action research skills. Each situation included 15 multiple-choice items measuring the five main research skills, and there were 3 questions in each situation to measure each skill alone. The test consisted of 60 items.

Face validity: The researchers presented the test to 10 experts and specialists in the field of

curricula and methods of teaching mathematics, science, and psychology who taught the research methods in education and psychology course for Master's degree students in the College of Education and were interested in action research. They gave their views of the statements in terms of their relevance and relatedness to action research skills, level of difficulty, and suitability for the study sample. Their suggestions resulted in modifications to the wording of some test items. The percentage of agreement among the reviewers of the test items was 80–100%.

Internal consistency: To verify the psychometric characteristics of the test, the researchers applied it to a sample of 42 female teachers of mathematics and science. The internal consistency of the test was measured by determining the Pearson's correlation coefficient between the scores of the respondents for each statement and the total score of the sub-skill to which it belonged. Correlations were also calculated between the total score for each of the five main skills and the teachers' scores in the test as a whole. (See Table 2.)

Table 2: Internal consistency coefficients for the action research skills test

Realizing and identifying the problem		**Reviewing the educational literature and formulating research hypotheses**		**Preparing and standardizing research tools**		**Specifying the research methodology**		**Interpreting results and documenting references**	
Item	Coeff.	Item	Coeff.	Item	Coeff.	Item	Coeff.	Item	Coeff.
1	0.614**	1	0.482**	1	0.343*	1	0.519**	1	0.564**
2	0.495**	2	0.582**	2	0.568**	2	0.312*	2	0.509**
3	0.361*	3	0.362**	3	0.620**	3	0.528**	3	0.349*
4	0.420**	4	0.737**	4	0.626**	4	0.339*	4	0.712**
5	0.469**	5	0.308*	5	0.341*	5	0.341*	5	0.473**
6	0.716**	6	0.456**	6	0.316*	6	0.568**	6	0.361*
7	0.742**	7	0.644**	7	0.620**	7	0.434**	7	0.514**
8	0.438**	8	0.589**	8	0.307*	8	0.435**	8	0.440**
9	0.403**	9	0.781**	9	0.566**	9	0.535**	9	0.365*
10	0.683**	10	0.523**	10	0.381**	10	0.525**	10	0.687**
11	0.525**	11	0.528**	11	0.341*	11	0.429**	11	0.390**
12	0.648**	12	0.650**	12	0.522**	12	0.666**	12	0.490**
Correlation of the skill to the test as a whole		**Correlation of the skill to the test as a whole**		**Correlation of the skill to the test as a whole**		**Correlation of the skill to the test as a whole**		**Correlation of the skill to the test as a whole**	
0.895* **		**0.904*** **		**0.776*** **		**0.809*** **		**0.864*** **	

Notes: * significant at .05, ** significant at .01

Table 2 indicates that there are significant positive correlations at the levels of 0.05 and 0.01 between the individual statements and the total score of the sub-skill. The correlation coefficients for the skill of realizing and identifying the problem were in the range 0.361–0.742, for the skill of reviewing educational literature and the formulation of hypotheses 0.308–0.781, for the skill of preparing and standardizing the research tools 0.307–0.626, for the skill of specifying research methodology 0.312–0.666, and for the skill of interpreting results and documenting references 0.349–0.712.

The correlations between the total scores for each skill and the total score of the test are strong, direct, and significant at the level of 0.01, with the values of the correlation coefficients being as follows: realizing and identifying the problem (0.90), reviewing educational literature and formulating hypotheses (0.91), for the skill of preparing and standardizing research tools (0.78), defining research methodology (0.81), and interpreting the results and documenting references (0.85). Thus, the results indicated that the test had good internal consistency.

Discriminant (divergent) validity: To calculate divergent or discriminant validity we divided the sample of verification of psychometric characteristics (n = 42) using Quartiles to determine the upper group, which includes those with the highest total scores on the test, and the lower group, which includes those with the lowest total scores. Then the differences between the two groups were estimated using the Mann–Whitney test; the results are shown in Table 3

Table 3: Results of the Mann–Whitney test to calculate the divergent validity of the action research skills scale

	Group	Number	Rank average	Rank total	U-value	Z-value	Sig.
Action research skills	Upper group	10	15.50	155.00	0.00	3.791	0.000
	Lower group	10	5.50	55.00			

Table 3 shows that for the total score of the action research skills test, the U-value was 0.00 and the Z-value was 3.791, with a very high level of statistical significance of (0.00). This means that there are statistically significant differences at a significance of < 0.01 between the mean scores of the upper group (mean rank = 15.50) and lower group (mean rank = 5.50). These results show the divergent validity of the scale and that it can discriminate between those with different abilities in action research skills.

Test reliability: The study established the reliability of the test using Cronbach's alpha coefficient and employing the half-splitting method for the sub-skills and the total score of the test. The Spearman–Brown coefficient was used to correct the effect of the splitting. Table 4 shows the results.

Table 4. Cronbach's alpha coefficients and half-splitting results for the action research skills test

Test dimensions	Cronbach's α	Half-splitting	
		Correlation coefficients between the two test halves	Spearman–Brown correction
1. Realizing and identifying the problem	0.784	0.603	0.753
2. Reviewing educational literature and formulating research hypotheses	0.796	0.665	0.798
3. Preparing and standardizing research tools	0.651	0.520	0.684
4. Specifying research methodology	0.671	0.540	0.701
5. Interpreting results and documenting references	0.661	0.570	0.726
The test as a whole	0.920	0.853	0.921

The results indicated acceptable reliability of the test based on the range of Cronbach's alpha values for the sub-skills of the test (0.661–0.784) and the half-splitting reliability coefficients (0.684–0.798). For the total scores of the test, the reliability coefficients were respectively 0.921 and 0.920.

Final form: After validating the validity and reliability, the final form of the test was as follows:

A. Basic data: name, school, test number, and test date.
B. General instructions: the purpose of the test, the number of statements, and the method of recording answers.
C. Test items: 60 statements distributed over 4 research situations measuring 5 dimensions.

Table 5 shows the final form of the distribution of test statements and their scores.

Table 5. Distribution of action research test questions and scores

	No.	Axis	Number of statements	Scores
Situations representing research problems	1	Realizing and identifying the problem	3	3
	2	Reviewing educational literature and formulating hypotheses	3	3
	3	Preparing and standardizing research tools	3	3
	4	Specifying research methodology	3	3
	5	Interpreting results and documenting references	3	3
	Number of situation statements		15	15
Total of the test as a whole			60	60

Application procedures: After obtaining the necessary administrative approvals, the experiment was applied to the study sample as follows:

- Applying the action research skills test before offering the training program
- Implementing the training program
- Re-applying the test in the same way after presenting the training program

Statistical analysis: The Kolmogorov–Smirnov test was used to verify the normality of the data distribution, the arithmetic means, and standard deviations, and paired-samples t-tests and eta squared (η2) were used to verify the effect size.

5. Results

To answer the research question ("What is the effectiveness of a proposed training program to develop action research skills among female mathematics and science teachers in Bisha?"), the Kolmogorov–Smirnov test was used to verify the data distribution, as shown in Table 6.

Table 6: Results of Kolmogorov–Smirnov testing of data distribution

Measurement	Value	df	Sig.
Pre	0.144	36	0.060
Post	0.139	36	0.075

The results show significance values greater than 0.05 for both measurements (pre and post), which indicates that the data followed a normal distribution, and therefore parametric methods were appropriate. Thus, a paired-samples t-test was undertaken to test the hypothesis: "There is no statistically significant difference at the significance level of $\alpha \leq 0.05$ between the mean scores of female mathematics and science teachers in action research skills before and after applying the proposed training program." Then, the effect size of the proposed training program was calculated, using Cohen's d for the paired-sample t-test, calculated using the equation √nt/. Cohen (1988) specifies the effect size levels as follows:

- Low effect size if the value is 0.2 (< 0.5)
- Average effect size if the value is 0.5 (< 0.8)
- High effect size if the value is ≥ 0.8

Table 7 shows the results of the t-test and Cohen's d coefficients for the effect size:

Table 7: Results of t-tests of the significance in differences between the mean scores in the pre- and post-tests of action research skills

Skill	Application	M	St. Dev.	t-value	Sig.	Cohen's d	Effect size
Realizing and identifying the problem	Pre	5.861	0.899	10.84	0.001	1.806	High
	Post	8.056	0.791				
Reviewing educational literature and formulating hypotheses	Pre	4.917	0.906	15.546	0.001	2.591	High
	Post	7.556	0.652				
Preparing and standardizing research tools	Pre	4.944	0.754	9.259	0.001	1.543	High
	Post	7.111	0.919				
Specifying research methodology	Pre	4.472	0.941	11.582	0.001	1.930	High
	Post	7.444	1.107				
Interpreting results and documenting references	Pre	5.167	1.105	11.489	0.001	1.914	High
	Post	8.250	1.105				
Skills as a whole	Pre	25.361	1.869	26.941	0.001	4.490	High
	Post	38.417	1.991				

Table 7 shows statistically significant differences (0.001) between the mean scores of female mathematics and science teachers with regard to the pre- and post-tests of each action research skill, as well as the test as a whole. This is in favor of their mean scores in the post-test, which gave values for the sub-skills in the range 9.259–15.546 and a total mean score for the test of 26.941.

The results also showed that the training program had a high effect size, with the values of Cohen's d coefficients in all sub-skills and the test as a whole greater than 0.8 (1.543–3.375). The skills most affected by the training program were reviewing educational literature and formulating hypotheses, followed by specifying research methodology. In third place was interpreting results and documenting references, then realizing and identifying the research problem. In fifth and last place came preparing and standardizing the research tools.

These results reject the null hypothesis, which states: "There is no statistically significant difference at the significance level of $\alpha \leq 0.05$ between the mean scores of female mathematics and science teachers at the primary school stage in action research skills before and after applying the proposed training program."

6. Discussion

The results showed a high effect size and the effectiveness of the proposed program in developing the skills of action research as a whole, as well as developing each skill individually: realizing and identifying the problem, reviewing educational literature and formulating hypotheses, preparing and standardizing research tools, specifying the research methodology, and interpreting the results and documenting the references. This is due to the variety of learning resources in the program, which included educational presentations, text files, and the presentation of examples and models of realistic research problems from the school classroom environment. It is also due to the variety of training techniques and styles, such as individual assignments, group discussions, brainstorming, and practical applications, which helped the participating female teachers to apply the theoretical content in employing action research skills and addressing the real problems they might face. The program addressed these applications through group discussions accompanied by feedback, continuous evaluation, and positive reinforcement, all of which had an impact on the exchange of experiences and information between female teachers and led to the desired goals of the program being achieved. The results of the study are consistent with those of several previous studies, for example, As-Sayed (2022), Abdel-Hamid (2018), Al-Arfaj (2020), Ash-Shanbari (2016), and Al-Otaibi (2016), which aimed to develop action research skills because of their recognized importance in developing teachers' pedagogy and professional performance.

7. Conclusion

The study concluded that the training program was highly effective in delivering development in action research skills, both generally and the five skills specifically. In light of the results, the researchers recommend that a culture of action research should be developed and disseminated among both male and female teachers. Moreover, research partnerships should be established between experts and male and female teachers in general education, with continuing profession development opportunities being offered to train teachers in action research. A qualitative study can also be conducted to identify male and female teachers' attitudes towards action research, and to study the challenges that male and female teachers face in carrying out action research. A study can also be conducted to assess the level of action research provided by teachers and to identify strengths and shortcomings.

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