

Effect of Artificial Intelligence Using Be My Eyes App on Knowledge and Practice regarding Breast Self-Examination among Female Adolescents with Visual Impairments

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Abstract

Artificial intelligence provides visually impaired adolescent females with a more inclusive and efficient method of learning procedures about breast self-examination, ensuring that they can identify and detect breast abnormalities early. **The study aims** to investigate the effect of artificial intelligence using the Be My Eyes app on knowledge and practice regarding breast self-examination among female adolescents with visual impairments. **Design:** A quasi-experimental design (pre/post-test) was utilized. **Setting:** The study was conducted at Al Noor School for visually impaired students in Shebein El-kom City, Menoufia Governorate. **Sample:** A purposive sample of 50 visually impaired female adolescents. **Tools:** Three tools were used to collect the data of the study: a structured interviewing questionnaire, a knowledge and practice assessment tool regarding breast self-examination through the Be My Eyes app, and an observational checklist of female adolescent practice. **Results:** The findings revealed a highly statistically significant difference in visually impaired females' adolescent total knowledge and practice scores for breast self-examination before and after using the Be My Eyes application. The adolescent female's total knowledge and practice improved in the posttest and follow-up compared to the pretest. **Conclusion:** Adolescent females with visual disabilities saw improvements in their BSE knowledge and practices as a result of using AI, also making health education more accessible. AI empowers adolescent females with visual disabilities to take control of their health in a way that was previously challenging due to their visual impairments. **Recommendations:** Future research should explore the development of more advanced AI systems that can be further personalized to suit the unique needs of adolescent females with varying levels of visual impairment.

Keywords: Artificial Intelligence, Be My Eyes app, Knowledge and Practice, Breast Self-Examination, and Female Adolescents with Visual Impairments.

Introduction

One of the most prevalent cancers in women worldwide is breast cancer, and the likelihood of a successful course of treatment is greatly increased by early diagnosis by self-examination. However, even with the documented advantages of breast self-examination (BSE), many women, particularly those with impairments, still struggle to complete these exams correctly and regularly. Because they cannot rely on visual clues to identify changes in their breast tissue, teenage girls with visual difficulties encounter particular challenges while learning and practicing breast self-examination. This accessibility gap frequently results in inadequate knowledge and application of crucial health practices (Van Nguyen et al., 2022).

Adolescence is a crucial developmental period during which people establish habits and behaviors that last a lifetime, including those connected to their health. When it comes to breast health awareness, young girls with visual impairments may ignore their health or feel unprepared or scared due to a lack of easily available teaching regarding BSE. According to (Bastani et al. 2020), the existing deficiency of easily available health education resources for teenagers with visual impairments, especially in the area of BSE, emphasizes the need for creative solutions that may address both knowledge and practical skills.

Artificial intelligence (AI) has been used in health education recently, creating new opportunities to improve accessibility and learning for people with impairments. AI-driven apps and assistive technology can offer users adaptive training, real-time direction, and audio feedback to enable them to do

challenging activities on their own. According to (Brenton et al., 2021), AI-based solutions can provide visually impaired teenage females with a more inclusive and efficient method of learning the procedures of breast self-examination, guaranteeing that they can detect possible health risks early.

Artificial intelligence (AI) is used by the Be My Eyes app to help people with vision impairments carry out daily chores. For a variety of jobs, the software that pairs sighted volunteers with visually impaired people has proven to be a priceless tool. The potential of this software has grown in recent years to include a variety of fields, including wellness, healthcare, and education. Its usage in breast self-examination (BSE) training for teenage girls is one creative use, particularly in areas where access to medical experts may be restricted (Simmons et al., 2023).

Breast self-examination is a critical skill that enables young women to detect early signs of breast abnormalities or potential cancer. Teaching adolescent females this vital skill can significantly contribute to early detection and improve the chances of successful treatment if any abnormalities are found. However, the challenge is to provide accurate, real-time, and user-friendly guidance to ensure these adolescents understand the process and perform it correctly (Bui & Lee, 2019).

The integration of the Be My Eyes app into BSE training enhances accessibility and education, making it more interactive and personalized. Be My Eyes provides an innovative solution by enabling live, real-time assistance during BSE training. By connecting adolescent females with volunteers (many of whom are healthcare professionals, educators, or trained individuals), the app allows for immediate guidance, feedback, and reassurance during the practice of BSE. Volunteers can assist users with step-by-step instructions, correct technique demonstration, and troubleshooting of any difficulties. This is particularly beneficial for young learners who may struggle with understanding written instructions or lack proper access to in-person healthcare resources (Yang & Liu, 2020).



Figure (1): Be my Eyes application on Google Play.

Incorporating artificial intelligence into Be My Eyes creates a more comprehensive tool for helping visually impaired individuals with tasks requiring visual input. The AI-driven components, such as object recognition, voice feedback, personalized health reminders, and real-time guidance, offer tremendous potential in health education, including the training of breast self-examination (BSE). AI allows the app to guide users through the examination process, provide detailed auditory feedback, and offer personalized support, thereby increasing the independence and confidence of visually impaired adolescent females in managing their health. In the context of breast self-examination training, Be My Eyes' AI-powered features play a crucial role in empowering visually impaired girls by providing them with the tools they need to confidently perform regular self-exams, ensuring early detection, and promoting better health outcomes (Bengio et al., 2020).

This research helps to explore the impact of Artificial Intelligence-assisted training on the knowledge and practice of breast self-examination among adolescent females with visual disabilities. By employing AI-based tools designed to deliver interactive, auditory, and haptic instructions, this study will investigate how such technology can improve understanding and execution of BSE techniques in this underserved group. The findings from this study could have significant implications for promoting health education, fostering independence in self-care practices, and ultimately contributing to the early detection of breast cancer in a vulnerable population.

Significance of the Study

In March 2024, President Abdel Fattah El-Sisi expressed significant support for women, particularly those with disabilities, through several statements. These statements

reflect President El-Sisi's commitment to improving the health and well-being of Egyptian women, especially those with disabilities, and enhancing their role in society.

A WHO study on disability states that 15% of the world's population—more than one billion people—have a disability of some kind, and between two and 4% of them have severe functional difficulties (Khalaf et al., 2023). In Egypt, breast cancer accounts for 35.1% of all cancer cases in women, making it a serious health concern. The high prevalence of vision impairment, which affects 11.8% of the population, makes matters more difficult since it makes it more difficult for visually impaired women to recognize breast abnormalities (El-Din& El-Nashar 2023).

Adolescent females in poor countries avoid BSE for several reasons, including cultural and religious views in Egypt. They may even feel uneasy or unwilling to touch or feel their breasts for medical reasons; hence, educational programs may make it more acceptable for girls to learn about and practice BSE, which can lead to psychological and physical health benefits (Nazari et al., 2022).

Traditional methods for teaching breast self-examination rely heavily on visual cues, making them impractical for individuals who cannot rely on their vision. The lack of alternative, accessible training methods contributes to a gap in knowledge and practice of BSE among this population, which may lead to delayed diagnoses and poor health outcomes (Baker& Huxley, 2019).

This research seeks to explore the feasibility and effectiveness of using AI-assisted BSE training to improve the knowledge and practice of breast self-examinations among adolescent females with visual disabilities. By incorporating AI technology, this study aims to provide a solution that can break down barriers, enhance accessibility, and promote proactive breast health management.

Aim of the Study

The study aims to investigate the effect of artificial intelligence using the Be My Eyes app on knowledge and practice regarding breast

self-examination among female adolescents with visual impairments.

Research hypotheses

H1: Artificial intelligence using the Be My Eyes app will improve Knowledge regarding Breast Self-Examination among Female Adolescents with Visual Impairments

H2: Artificial intelligence using the Be My Eyes app will improve Practice regarding Breast Self-Examination among Female Adolescents with Visual Impairments

Operation definition

Be My Eyes App: A mobile application that connects visually impaired individuals with sighted volunteers through live video calls, enabling real-time assistance with tasks requiring vision. In research or practice, it may be measured by user engagement (e.g., number of calls made, duration of assistance), accessibility improvements, or user satisfaction.

Adolescent Females: Young females aged 12–18 years, as defined by the World Health Organization, who are the target population for breast self-examination training programs.

Visual Impairments: Partial or complete impairment of vision that affects an individual's ability to perform daily tasks without assistance, necessitating adaptive educational tools for learning self-examination techniques.

Knowledge: The level of awareness, understanding, and information retention among adolescent females regarding breast self-examination, breast health, and the role of AI-assisted tools in self-screening.

Practice: The ability of adolescent females, particularly those with visual disabilities, to correctly perform breast self-examination techniques after receiving AI-assisted training, as measured by competency checklists or self-reported adherence.

Study Design

A quasi-experimental design (pre-, post- & follow-up test) was carried out.

Study Settings

The study was conducted at Al Noor School for visually impaired students in Shebin El-Kom City, Menoufia Governorate.

Sample Type: A purposive sample of 50 visually impaired female adolescents was included in the study (targeting specific participants who meet the inclusion criteria). The participants were all adolescent, visually impaired females. They were from rural and urban areas and were enrolled in Al Noor School for visually impaired students in Shebin El-kom City, Menoufia Governorate.

• Inclusion Criteria:

- Adolescent females aged 12-18 with visual disabilities (e.g., blind or low vision).
- No previous history of breast cancer diagnosis.
- Access to the required technology (smartphones, wearables, etc.) for AI-assisted training.

• Exclusion Criteria:

- Adolescent females with severe cognitive impairments that may prevent understanding or practicing BSE.
- Those who are already trained in self-examination or receiving ongoing breast health training.

Sample size: Sample size calculation:

Daniel's (1999) method, $n = Z^2 P (1-P) / d^2$, was used to determine the sample size. The sample size is denoted by n in this computation, and the prevalence of adolescent females, P , was found to be 8% in a previous study conducted in Egypt (Ameen, Hany, & Ali, 2023). There was a 5% margin of error and a 95% confidence level. Given $d = 0.05$ and $Z = 1.96$, the formula for n is $(1.96)^2 0.08 (1-0.08) / (0.05)^2$. A total sample size of 50 adolescent females is needed.

Tools for Data Collection

These tools, when integrated effectively, provide a comprehensive approach to AI-assisted BSE training for adolescent females with visual disabilities. Data were collected using the following tools:

Tool (I): Structured Interview Questionnaire Sheet

Developed by the researchers after reviewing related literature, this tool assessed the sociodemographic characteristics of adolescent females with visual impairments. It was divided into two parts:

Part 1: Socio-demographic characteristics, including name, age, number of family members, telephone number, family income, education level, mother's education, and place of residence.

Tool (II): Knowledge Assessment Tool Regarding Breast Self-Examination

Developed in Arabic by the research team, this tool assessed participants' knowledge about BSE before and after using the Be My Eyes app. It consisted of 13 multiple choice questions about knowledge of breast self-examination (Simmons et al., 2023). Key questions covered:

- Awareness of breast cancer and self-examination methods
- Importance of regular BSE
- Correct practice of BSE
- Identifying potential abnormalities or changes in the breast

Scoring System:

- (0) Incorrect answer
- (1) Correct answer Knowledge levels were classified as:
- Good ($\geq 70\%$)
- Fair (51–69%)
- Poor ($\leq 50\%$)

Tool (III): Observational Checklist of BSE Practice Using Be My Eyes App

Developed after reviewing related literature, this tool is developed to assess the practice of Breast Self-Examination (BSE) among visually impaired adolescent females before and after using the Be My Eyes app. This app assists with video calls, enabling visually impaired individuals to receive real-time guidance from sighted volunteers to aid them in performing BSE. The checklist aims to evaluate the improvements in the adolescent's practice, confidence, and ability to independently carry out BSE after the use of the application. The checklist contains a total

of 31 statements across various categories such as preparation, technique, confidence, emotional comfort, and independence (Murdoch, 2019).

Scoring System:

- (1) Done Practice
- (0) Not done practice.

The total scores of practices were classified as:

- Satisfactory ($\geq 60\%$)
- Unsatisfactory ($< 60\%$)

Validity of the Tool

The researcher created the data collection tools and then reviewed them by a panel of five professors specializing in maternal and newborn health nursing from Menoufia University. These experts evaluated the instruments for suitability, clarity, applicability, and overall design. Based on their feedback, modifications were made.

Reliability of the Tool

The reliability of the tools was assessed using Cronbach's alpha coefficient, which resulted in a value of 0.76, indicating high reliability.

Pilot Study

A pilot study was conducted with 10% of the research sample, involving five randomly selected females. The pilot study aimed to assess the relevance, clarity, and usability of the data collection instruments. Based on the feedback, several adjustments were made to the survey, including revisions to certain questions about the girls' knowledge and practices. The participants in the pilot study were excluded from the sample.

Ethical Considerations

Primary approval was taken from the Ethical Research Committee at the Faculty of Nursing Menoufia University on 20/9/2023, code No: (799) before conducting the study. After explanations before enrollment in the study, informed consent was obtained verbally from all females. Each female was informed that participation in the study was voluntary, and that she could withdraw from the study whenever she decided.

Procedure of Data Collection

The data collection process in this study was conducted through the following phases:

1. Assessment Phase

During this phase, researchers evaluated participants' knowledge, beliefs, and practice regarding breast self-examination (BSE) using the study tools. Each participant was introduced to the researchers, who provided a clear verbal explanation of the study in accessible terms. Since the participants were visually impaired, researchers completed the questionnaires on their behalf, ensuring clarity and understanding of the instrument contents. A responsible individual from the association was present during data collection. Completing each questionnaire required approximately 20–30 minutes per participant. Data collection sessions occurred twice weekly from 9 a.m. to 1 p.m. Participants were informed that a post-test and follow-up assessment using tools (I, II, III) would be conducted after the AI application intervention (Be My Eyes App). The post-test is done immediately after the intervention, while the follow-up test is done after three months.

2. Implementation Phase

Based on findings from the assessment phase and a review of related literature, adolescent females used the AI-assisted app Be My Eyes, which guided them through the BSE process, provided feedback, and allowed for practice. The training program consisted of a series of sessions designed to teach correct BSE techniques over a specified period. Researchers provided technical support to ensure the smooth use of the AI app, addressing any challenges encountered by participants.

This phase passes through three stages: **The first stage**, the objectives of this stage are to educate adolescent females about the importance of BSE and teach them the correct techniques for performing BSE. Provide an accessible and supportive resource for self-examination guidance. In this stage, the researchers provided training education for adolescent females with visual impairments, about knowledge and practice of Breast Self-Examination (BSE) using the Be My Eyes App.

Introduction to the Be My Eyes App throw:
App Overview: Provide a brief overview of the Be My Eyes app, explaining how it connects individuals with trained volunteers to assist with tasks that require vision. Then studied females began to: **Step-by-Step Guide: Using *Be My Eyes* for BSE**

1. Download the App

- Participants downloaded *Be My Eyes* from the Google Play Store or Apple App Store.
- Permissions such as voice access were granted to allow sighted volunteers to assist effectively.

2. Understand the Purpose

- Participants were informed that they would receive guidance for performing a BSE, including checking for unusual lumps, changes in breast shape, skin texture, or nipple discharge.
- They were reminded that *Be My Eyes* provides visual assistance but does not replace medical evaluation.

3. Connect with a Volunteer

- Participants selected "Get Help" in the app to connect with a sighted volunteer.
- The volunteer joined the call, and the participant explained the task: assistance with performing a BSE.

4. Prepare for the Examination

- Participants were instructed to find a comfortable, private space with good lighting.

5. Follow the Volunteer's Instructions

- Volunteers provided detailed, step-by-step guidance, including:
 - Lying down with one arm raised over the head for palpation.
 - Using fingertips to check for lumps or unusual textures.

6. Check for Nipple or Areola Changes

- Volunteers helped participants check for nipple discharge or changes in shape.

7. Ensure Full Coverage

- Participants were guided to examine all parts of the breast—upper, lower, inner, and outer areas.
- Both standing and lying positions were recommended for thorough detection.

8. Address Any Findings

- If abnormalities were detected, volunteers provided visual assistance.
- Participants were encouraged to seek medical evaluation for further examination.

9. End the Call and Review Results

- Participants could ask follow-up questions after completing the self-examination.
- Any significant findings were noted, and medical consultation was recommended if needed.

This training took three sessions per week, each lasting about 45 minutes. The first session covered knowledge about BSE. The second session was practice, and the third one was a revision to confirm the females' ability to demonstrate the BSE procedure perfectly. **Second stage.** The researcher completed and refreshed the previously mentioned information by asking them some related questions to assess the improvements in the adolescents' knowledge of BSE before and after the app implementation. Missed or unclear points were re-emphasized by the researchers and discussed with them. **Third stage:** at the end, the researchers asked the females if they needed to repeat the explanation and discuss the answers to all questions to make them clear in all aspects of the program.

Additional steps for safe and effective use of Be My Eyes App

- **Safety and Comfort:** Ensure privacy and a comfortable setting for performing the self-examination.
- **Educational Support:** Volunteers reinforced the importance of monthly self-exams for early detection.

3. Evaluation Phase

Post-Test Assessment

Immediately after the intervention, participants' knowledge and practice of BSE were reassessed through:

- **Knowledge Test:** The same questionnaire used during the pre-test was administered to measure improvement in understanding breast health and BSE.
- **Practical Assessment:** Participants demonstrated their ability to perform BSE

using the *Be My Eyes* app, following the correct steps and techniques.

BSE Knowledge Provide training on what Breast Self-Examination is and why it is important for breast health. Use audio and tactile materials to ensure the adolescents understand the steps involved in performing BSE. Breast models were used to allow participants to palpate and distinguish between normal and abnormal conditions. Participants practiced the procedure with re-demonstrations to ensure mastery of the technique.

Follow-Up Assessment

A follow-up evaluation was conducted three months post-intervention to assess knowledge retention and continued practice of BSE using the same study tools (I, II, III).

Statistical design:

After completing data collection, responses were analyzed using SPSS Statistics version 22. Quantitative data were summarized using means and standard deviations, while qualitative data were expressed as percentages. The Pearson correlation test was employed to determine relationships, with a significance level set at 0.05.

Results

Table 1 presents the sociodemographic characteristics of the studied visually impaired adolescent females. The majority of participants (60%) were aged between 12-14 years, with 40% in the 15-18 years range, with a mean age of 15.36 ± 2.64 . Regarding parental education, a significant percentage of fathers (30%) had no formal education, while 42% had completed secondary education and 16% had a university degree. The mother's education level showed a similar trend, with 14% unable to read and write, and 58% having secondary education, while 16% had university-level education. Concerning employment, most fathers (92%) were employed, while the majority of mothers (84%) were housewives.

Figure 2 shows the total knowledge score of the study participants about breast self-examination. It illustrated that the studied participants had good knowledge in the post-

and follow-up tests (100% and 98% scores), compared with 2% and 4% of them had poor knowledge about breast self-examination after they used the *Be My Eyes* app about BSE.

Table (2) illustrates the total knowledge score regarding the aspect of breast self-examination of visually impaired adolescent girls pre-, post, and follow-up. The data shows a significant improvement in their knowledge across all categories. Overall, the study demonstrated a highly significant improvement in the girls' BSE-related knowledge, indicating the strong impact of the artificial intelligence (*Be My Eyes* APP) sustained over time ($P < 0.001$).

Table 3 reveals that the Participants' Breast Self-Examination (BSE) practice significantly improved from the pre-test to the post-test and follow-up test, as shown in the table. In the pre-test, all participants initially completed 100% of the BSE steps incorrectly (i.e., "NOT DONE"). Most items on the post-test showed above 90% compliance after the intervention using the *Be My Eyes* App, indicating a significant improvement in right behaviors (e.g., 98% or higher for utilizing the pads of fingers and following circular or up-and-down patterns). The percentages showed retention of the taught practices by the follow-up test, which showed a minor fall but remained much higher than the pre-test.

Figure 3 reveals the total practice score of the study participants about breast self-examination. It illustrated that 100% and 90% of the studied participants had competent practice in performing breast self-examination in the post- and follow-up tests compared with 2% and 10% before using *Be My Eyes* app about BSE.

Table (4) illustrates a significant positive correlation between knowledge and practices regarding breast self-examination at both the pre- and post-test stages, as well as after 3 months. The correlation coefficient (R) increases from 0.376 in the pre-test to 0.587 in the post-test, with both correlations showing statistical significance ($P = 0.007$ for pre-test and $P < 0.001$ for post-test).

Table (1): Sociodemographic Characteristics of the Study Participants (n = 50)

Sociodemographic	No.	%
Age		
12- 14 years	30	60.0
15-18 years	20	40.0
Mean ± SD	15.36 ± 2.64	
Number of family members		
3-4	36	72.0
5-6	14	28.0
Education mother		
Not read and write	7	14.0
Read and write	6	12.0
Primary	0	0.0
Preparatory	0	0.0
Secondary	29	58.0
University	8	16.0
High education	0	0.0
Education father		
Not read and write	15	30.0
Read and write	6	12.0
Primary	0	0.0
Preparatory	0	0.0
Secondary	21	42.0
University	8	16.0
High education	0	0.0
Occupation Father		
Not work	4	8.0
Work	46	92.0
Occupation Mother		
Housewife	42	84.0
Work	8	16.0

Pre, Post, and Follow-up Knowledge Score of the Study Participants Regarding Breast Cancer (n = 50)

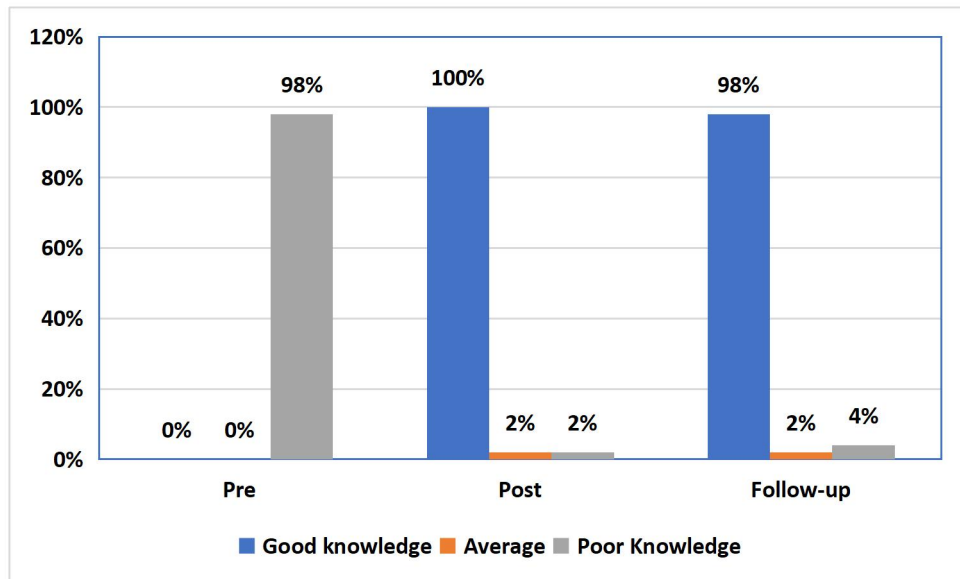


Table (2): Total Knowledge Level Score Regarding Aspects of Breast Self-Examination of Study Participants Pre, Post, and Follow-up (n = 50)

Regarding breast self-examination	Pre-test		Post-test		Follow Up		Test of Sig.	P
	No.	%	No.	%	No.	%		
Definition of BSE and breast cancer								
Poor (<50%)	48.0	96	0.0	0.0	0.0	0.0	Fr = 96.160	<0.001
Fair (50–75%)	2.0	4.0	0.0	0.0	4.0	6.0		
Good (≥75%)	0.0	0.0	50.0	100.0	47.0	94.0		
The BSE aims to detect breast problems and signs and symptoms of breast cancer.								
Poor (<50%)	49.0	98.0	0.0	0.0	0.0	0.0	Fr = 86.746	<0.001
Fair (50–75%)	1.0	2.0	1.0	2.0	2.0	4.0		
Good (≥75%)	0.0	0.0	49.0	98.0	48.0	96.0		
Importance of BSE								
Poor (<50%)	49.0	98.0	0.0	0.0	0.0	0.0	Fr = 98.737	<0.001
Fair (50–75%)	1.0	2.0	0.0	0.0	1.0	2.0		
Good (≥75%)	0.0	0.0	50.0	100.0	49.0	98.0		
The recommendation for performing BSE on a monthly								
Poor (<50%)	47.0	94.0	0.0	0.0	0.0	0.0	Q = 84.000	<0.001
Fair (50–75%)	3.0	7.0	0.0	0.0	1.0	2.0		
Good (≥75%)	0.0	0.0	50.0	100.0	49.0	98.0		
The timing of BSE								
Poor (<50%)	50.0	100.0	0.0	0.0	0.0	0.0	Fr = 99.000	<0.001
Fair (50–75%)	0.0	0.0	0.0	0.0	1.0	2.0		
Good (≥75%)	0.0	0.0	50.0	100.0	49.0	98.0		

Fr: Friedman test **Highly statistically significant P < 0.001

Table 3: Pre, Post, and Follow-up-Test Practice of the Studied Participants Regarding Breast Self-Examination (n = 50)

Items	Pre-Test Practice				Post-Test Practice				Follow up-Test Practice				
	DONE		NOT DONE		DONE		NOT DONE		DONE		NOT DONE		
	No	%	No	%	No	%	No	%	No	%	No	%	
Lie flat on your back with a towel or pillow placed under one shoulder. This helps flatten the breast tissue for easier examination.	0	0.0	50	100.0	48	96.0	2	4.0	45	90.0	5	10.0	<0.001
Use your opposite hand to examine each breast (right hand for left breast, left hand for right breast).	0	0.0	50	100.0	47	94.0	3	6.0	42	84.0	8	16.0	<0.001
Use the pads of your three middle fingers, keeping them flat and together.	0	0.0	50	100.0	49	98.0	1	2.0	47	94.0	3	7.0	<0.001
Examine one breast at a time using one of these patterns:	0	0.0	50	100.0	48	96.0	2	4.0	47	94.0	3	7.0	<0.001
Circular: Move fingers in small, overlapping circles starting from the outer edge toward the center.	0	0.0	50	100.0	48	96.0	2	4.0	45	90.0	5	10.0	<0.001
Up-and-Down Lines: Move your fingers vertically across the breast from top to bottom.	0	0.0	50	100.0	46	92.0	4	8.0	44	85.0	6	15.0	<0.001
Wedge: Start at the nipple and move outward toward the edges like spokes on a wheel.	0	0.0	50	100.0	49	98.0	1	2.0	45	90.0	5	10.0	<0.001
While standing (preferably in the shower), repeat the manual examination process using the same patterns.	0	0.0	50	100.0	48	96.0	2	4.0	46	92.0	4	8.0	<0.001
Examine the underarm (axillary) area for lumps or unusual changes as breast tissue extends here.	0	0.0	50	100.0	49	98.0	1	10.0	46	92.0	4	8.0	<0.001
Follow the same steps for the other breast, ensuring a thorough and consistent examination.	0	0.0	50	100.0	49	96.0	2	4.0	46	92.0	4	8.0	<0.001

*Highly statistically significant $P < 0.001$

Pre- Post and Follow-up Scores Regarding Total Practice Score of the Study
Participants about Breast Self-Examination

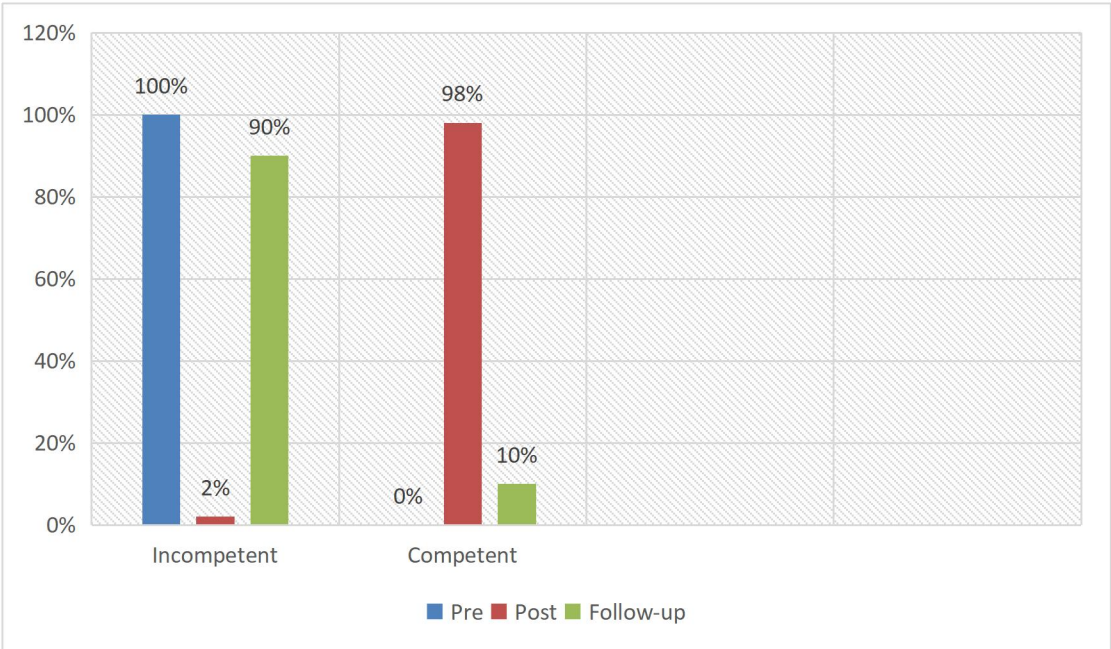


Table (4): Correlation among Knowledge and Practices of BSE Regarding the Use of *Be My Eyes* App (n = 50)

Variables		Knowledge regarding breast self-examination	
		Pre	Post and follow up
practices regarding breast self-examination			
(Correlation coefficient)	R	0.376	0.587
(Statistical significance)	P	0.007	<0.001

Discussion

Breast cancer is a leading cause of mortality among women globally, with early detection through self-examination being one of the most effective strategies for reducing the associated risks. For visually impaired female adolescents, the lack of accessibility to resources and support regarding breast health can make it challenging to gain proper knowledge on breast self-examination (BSE) and breast care. The advent of mobile applications like *Be My Eyes*, which connects visually impaired individuals to sighted volunteers through live video calls, has the potential to bridge these gaps in knowledge. This discussion will explore the knowledge of visually impaired female adolescents on breast self-examination and breast care before and after the use of the *Be My Eyes* application (Brennan et al., 2020).

Visual impairment, which affects millions of adolescents globally, has substantial implications for their ability to access health information, including breast health. Adolescents, especially females, face unique developmental challenges that are compounded by visual impairment. Without visual access to educational materials, these adolescents are often left without the necessary knowledge to perform breast self-examination or engage in proper breast care. (Barthel et al., 2021).

Concerning the age of the adolescent female, the current research was conducted on a sample of female adolescents with a visual disability who are registered at El Noor school in Menoufia governorate, with ages 15.36 ± 2.64 . It was determined that most participants in the study were over 14 years of age. The researcher chose this age group because it is a fact that participants

in this target group lacked awareness regarding obtaining information about breast self-examination and breast cancer. This comes in agreement with a study by Abd El-Mohsen (2021), which sought to “enhance the knowledge, beliefs, and practices of undergraduate female nursing students at Al-Azhar University regarding breast self-examination and its instruction. The research took place at the Health Technical Institute for female students at Al Azhar University, involving 113 female student nurses aged between 15 and 18 years. It discovered that over two-thirds of them were fifteen years old.

Concerning the knowledge of the study participants about breast cancer, all adolescent female participants had low levels of knowledge about breast cancer and breast self-examination; however, following the post-test, the majority of participants' knowledge improved. Before the *Be My Eyes* application, all study participants had low knowledge scores about breast cancer and breast self-examination; however, following the intervention and using the application, the majority of participants' knowledge scores increased in the post-test and follow-up tests.

From the researcher's perspective, the findings highlight a significant improvement in the participants' knowledge about breast self-examination and breast cancer after using the *Be My Eyes* application. Initially, all adolescent female participants exhibited low levels of knowledge regarding both breast cancer and breast self-examination. However, after engaging with the application as part of the intervention, there was a marked increase in knowledge scores during the post-test and follow-up test. This suggests that the *Be My Eyes* application played a key role in enhancing the participants' understanding of breast cancer and self-examination techniques. The results indicate the potential of technology-based interventions in improving health education for visually impaired individuals, particularly in promoting breast health awareness.

The current study findings are similar to **Jadhav and Deneen (2020)**, who reported that before using the *Be My Eyes* application, many visually impaired female adolescents often demonstrated a limited understanding of breast self-examination and breast care. Adolescents with visual impairments are often unaware of the

importance of regular breast checks due to the lack of tailored health education programs.

This conclusion is reinforced by **Brennan & Williams (2020)**, who found that the absence of easily accessible and appropriately designed materials for these adolescents has led to lower levels of awareness compared to their sighted peers. From the researchers' point of view, the *Be My Eyes* application provides a valuable tool for enhancing the knowledge of visually impaired female adolescents about breast self-examination and breast care. Before using the application, many adolescents lack comprehensive knowledge about breast health, but after interacting with trained volunteers through the application, they demonstrate a greater understanding of proper breast care techniques.

The findings align with another research investigating the "assessment of breast cancer awareness and breast self-examination behaviors among teenage blind girls in Qena Governorate." Thirty-seven blind girls participated in this investigation. The results came in the same line as the present results in improvement of knowledge of BSE after the training program with a significant difference after the program. The level of knowledge increased from ten percent before intervention to more than seventy after intervention (**Mohamed et al., 2021**).

The current study finding revealed that all female participants, before using the *Be My Eyes* application, did not know how to practice breast self-examination, while following the use of the application, the practice score improved on the post-test and follow-up test after three months. All participants received enough instruction on how to use the application to perform breast self-examination, which resulted in increased practice scores. From the researcher's perspective, the findings of the current study indicate a clear improvement in the participants' ability to practice breast self-examination (BSE) after using the *Be My Eyes* application. Initially, none of the female participants knew how to perform BSE. However, after using the application, there was a significant increase in their practice scores, as observed in both the post-test and follow-up test conducted three months later. This improvement can be attributed to the comprehensive guidance provided through the application, which ensured that all participants received the necessary

instruction to perform BSE correctly. The results suggest that the *Be My Eyes* application effectively enhanced the participants' practical skills in breast self-examination, contributing to better health practices among visually impaired adolescents.

This result matches (Barthel et al., 2021) and Jadhav and Deneen (2020), which indicates that many adolescents with visual impairments lack the knowledge and skills to perform BSE effectively. A significant number of visually impaired adolescents do not engage in regular breast self-examinations due to the absence of accessible resources or instructional tools that are tailored to their specific needs (Jadhav & Deneen, 2020). Before using the *Be My Eyes* application, visually impaired female adolescents generally exhibit poor or inconsistent practices regarding breast self-examination. Furthermore, Miller et al. (2020) added that many visually impaired adolescents report relying on family members, peers, or caregivers to assist with breast care, but the lack of formal education on breast health further contributes to inconsistency. In addition, a study by (Ballard & Green, 2022) noted that some visually impaired adolescents were unaware of the recommended frequency for performing BSE or the changes in breast tissue to look out for, which significantly hindered their ability to monitor their breast health effectively.

This finding also was similar to a study by Thompson et al. (2021), who demonstrated that after using *Be My Eyes*, visually impaired adolescents were more likely to engage in regular BSE and report greater accuracy in their self-examination practices. This was largely attributed to the ability of the volunteers to provide real-time corrections and to reinforce proper techniques during the process. Additionally, *Be My Eyes* also allowed adolescents to learn through repeated practice, which helped them develop knowledge and confidence in identifying abnormalities (Miller, R., et al., 2021).

Moreover, *Be My Eyes* has also empowered visually impaired adolescents to take a more proactive approach to their overall breast health. Adolescents who had previously been unaware of the signs of breast abnormalities reported increased awareness after using the app. They were better equipped to recognize changes in breast tissue and understand when to seek

medical advice, thus promoting better long-term breast care practices (Thompson et al., 2021). From the researcher's point of view, another key benefit is the sense of empowerment that many visually impaired adolescents gain after learning how to perform breast self-examination. Before using the application, these adolescents often felt dependent on others for their breast health management. After engaging with *Be My Eyes*, many adolescents experienced a newfound independence in caring for their bodies, contributing positively to their self-esteem and overall well-being. *Be My Eyes* has played a pivotal role in fostering such independence.

Before using the *Be My Eyes* application, the follow-up of the study participants to breast self-examination was generally low. A significant number of visually impaired female adolescents had limited or no knowledge of the importance of regular BSE and follow-up. Many participants reported either never performing BSE or only doing so irregularly, often due to a lack of understanding of how to perform the examination independently. Following the introduction of *Be My Eyes*, the study found a significant increase in the follow-up of participants to breast self-examination. The real-time guidance provided by sighted volunteers played a crucial role in overcoming the barriers that previously hindered the participants' ability to perform BSE.

From the researcher's perspective, before using the *Be My Eyes* application, the study participants had limited engagement with breast self-examination (BSE), with many visually impaired female adolescents having little to no understanding of its importance or how to perform it regularly. A significant number of participants reported never or only occasionally performing BSE, often due to the challenges of doing so independently. However, following the introduction of the *Be My Eyes* application, there was a notable improvement in the participants' follow-up with BSE. The real-time guidance provided by sighted volunteers was identified as a key factor in overcoming the barriers that had previously prevented the participants from conducting regular self-examinations. This suggests that the app effectively supported adolescents in performing BSE, making it more accessible and manageable for them.

This conclusion is reinforced by **Jadhav & Deneen, (2020)**, which also found a positive impact of the *Be My Eyes* application on the follow-up of visually impaired female adolescents to breast self-examination. By providing real-time assistance, emotional support, and personalized guidance, *Be My Eyes* helps overcome the unique challenges faced by visually impaired individuals in practicing BSE. The app significantly increased the regularity, confidence, and understanding of breast health among participants, empowering them to take a proactive role in their health care.

Conclusions:

Based on the results of the current study, it can be concluded that the *Be My Eyes* application, as a part of artificial intelligence training *Be My Eyes* application, provides a valuable tool for enhancing the knowledge and practice of visually impaired female adolescents about breast self-examination. The current findings revealed that there was a highly significant difference between the pre-, post, and follow-up tests about the knowledge and practice of visually impaired female adolescents about breast self-examination this supports the study hypothesis.

Recommendations

Based on the findings of the present study, the following recommendations are:

- *Be My Eyes* application should be implemented in schools, particularly those that serve visually impaired students, to raise awareness about breast self-examination.
- The "*Be My Eyes*" app should be utilized as a tool for visually impaired adolescents to conduct regular self-examination and check for abnormalities regarding breast self-examination.

Limiation of the study

- Not all female adolescents have a reliable internet connection to use the *Be My Eyes* App.
- Some female adolescents face difficulties in using the *Be My Eyes* App.

Further research:

Further research should be conducted to evaluate the impact of the "*Be My Eyes*" app in enhancing knowledge and practices related to breast self-examination among visually

impaired adolescents. Studies should examine whether this technology improves the accuracy, confidence, and frequency of breast self-exams performed by users.

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Conflict of Interest:

No conflict of interest was found.

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