BSU Journal of Pedagogy and Curriculum

2023; 2 (3): 1-10

https://bsujpc.journals.ekb.eg/

ISSN: 2812-5851 (Print); ISSN: 2812-586X (Online)

Regular Article

CREATING SPECIAL GEOMETRICAL TOOLS FOR THE BLIND PUPILS

Abd El-Rahman, Madiha Hassan Mohamed

Department of Curriculum &Instruction, Faculty of Education, Beni-Suef University (EGYPT)
madiha.hassan@edu.bsu.edu.eg
madihahm2004@yahoo.com

APA Citation: Abd El-Rahman, M. (2023). Creating Special Geometrical Tools for Blind Pupils. *BSU Journal of Pedagogy and Curriculum; 2(3): 1-10*

Received: 18/10/2022; **Accepted**: 20/9/2022 ; **Published**: 01/01/2023

ABSTRACT

This research aims to help blind pupils in the fourth grade learn construction geometry (CG). For that purpose, some special geometrical tools were created from Egyptian environmental *materials to help blind pupils learn CG. The effectiveness of these tools was measured after being implemented on a sample of blind pupils (N=5) in fourth grade. Some recommendations of the research were included.*

KEYWORDS: Geometrical tools; blind pupils; Construction Geometry**.**

INTRODUCTION:

Geometry is most useful for any person, such as blind pupils. However, blind pupils, mainly those passionate about establishing themselves in science and mathematics, find it difficult to continue their studies (Vandana & Singla; A., 2022). For that, many attempts were made to help them learn geometry (e.g., Roth, Petucci & Pun, 2000) who have created "From Dots to Shapes" - an auditory game platform that aims to help educators teach blind and visually impaired students' basic Euclidean geometry. Furthermore, Rouzierl et al. (2004) discovered an electronic system called SALOME that uses haptic and auditory modalities to teach simple geometry. Azevedo, A. C. & Santos, A. C. F. (2014) suggested magnetic boards and rubber magnet strips to help the visually impaired with graphics and diagrams. Tanti, M. (2015) used the spur wheel to help blind pupils draw lines. Junthong, N. et al. (2020) created plastic

geoboards and accessories as geometry teaching tools for visually-impaired students using 3D printing.

Despite all these significant developments that occurred in the field of teaching geometry to blind pupils all over the world, teaching geometry to blind pupils in Egypt has many problems such as:

- They do not study construction geometry
- They have no special geometrical tools.
- They only study how to construct simple geometrical shapes using the Tayler board. This board caused some mistakes for pupils, such as: drawing a line segment (L=4cm instead of 5cm), because he/she counted the number of pieces he/she used instead of counting the distance between the pieces.

According to some researchers, "Any student can reach his or her cognitive potential when instruction is tailored to individual needs." (Pritchard & Lamb, 2012, p. 26); therefore, the researcher tried to create special geometrical tools for blind pupils using some environmental materials in Egypt. These tools must have the following criteria:

- Cheap.
- Safe for blind pupils.
- Easy to use.

THE PROBLEM OF THE RESEARCH:

Blind pupils in Egypt did not study construction geometry. But these pupils always prefer to do everything as normal ones. For that this research tries to help these pupils learn construction geometry with new special geometrical tools.

THE OBJECTIVES OF THE RESEARCH:

- Creating special geometrical tools for blind pupils.
- Measuring the effectiveness of these tools on the blind pupils' skills in drawing some geometrical constructions.

THE SAMPLE OF THE RESEARCH:

One class from the fourth-grade pupils (N=5) in an Egyptian school.

THE LIMITATIONS OF THE RESEARCH:

The research was limited to:

- Sample from fourth-grade blind pupils.
- Construction geometry lessons in the fourth mathematical curriculum. These lessons are: Measuring the length of a line segment - Estimate the length of a line segment –Drawing a line segment with a given length – Measuring the angle – Estimating the measure of the angle – Drawing angle with a given

measure – Drawing square – Drawing a rectangle– Drawing a triangle given the lengths of two sides and the measure of the included angle.

THE PROCEDURES OF THE RESEARCH:

- Reviewing the mathematical textbook for the normal pupils in the elementary stage to determine the construction geometry lessons and their objectives.
- Reviewing the previous studies in this field.
- Making a theoretical study about teaching geometry to blind pupils in the elementary stage.
- Creating special geometrical tools from the environmental materials for blind pupils to learn these lessons.
- Carrying out a pilot study of the new geometrical tools on one blind pupil to ensure these tools achieve their aims.
- Developing a test in construction geometry.
- Choosing one class from the fourth-grade blind pupils (N=5) in the elementary stage.
- Implementing the test on the sample of the research as a pre-test.
- The blind pupils learned the construction geometry lessons by using the suggested geometrical tools.
- Implementing the same test on the sample of the research as a post-test.
- Analyzing the results and putting some recommendations and suggestions.

DESIGNING SPECIAL GEOMETRICAL TOOLS FOR THE BLIND PUPILS:

Geometrical Board

Mostafa (1981) used aluminum foil with blind pupils in education art. The current research used this result and looked for a suitable material which must be put under the foil to help blind pupils feel the drawing. Many attempts were made with some materials, such as a piece of wood, braille paper, cardboard, rubber, and wool. In the end, the researcher found that the back of the carpet is handy to sense by drawing on the aluminum foil. The final geometrical board can be shown in the following figure:

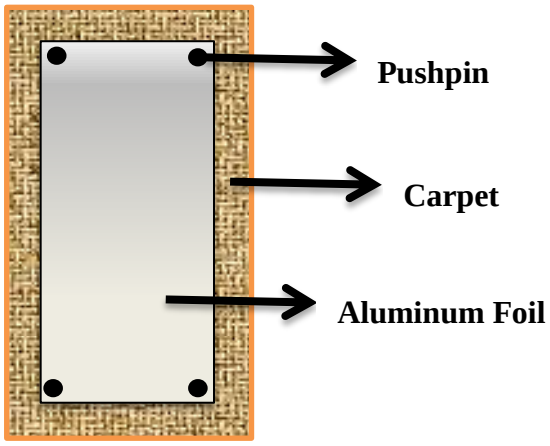

Figure (1) Geometrical Board

This geometrical Board consists of:

- A Piece of Carpet (35*30 cm)
- An Aluminum foil board (30*25 cm).
- 4 Pushpins to fix the aluminum foil on the back of the carpet.

Advantages of this board:

- The board does not need a special pen to draw; the pupil can use a braille pen to draw on foil.
- The blind pupil can feel his drawing on both sides of the foil.
- The foil can help blind pupils have a correct concept of the line.
- The foil helps the blind pupil to draw and delete any shape many times without cutting (by the back of the braille pin). That means it is more economical than braille paper.
- The carpet was not affected by the drawing pins. It is also very economical.

Drawing pin:

The blind pupil needs to feel or sense his drawing in each step. In the beginning, the sewing pins were used, but this pin was too long and fell during drawing. For that, a unique drawing pin was created as follows:

Figure (2) Sewing pin Figure (3) Cutting Figure (4) Heating Figure (5) Pasting

- Use sewing pins (figure 2) and cut them 1 cm from the top (figure3).
- Bring a plastic bead (figure 4) and heat the second part of the pin, and insert it into the plastic Bead to get the final shape of the drawing pin (figure5)

Protractor:

A typical plastic protractor was used and made a hole in each degree in the outer edge of the protractor (figure 6).

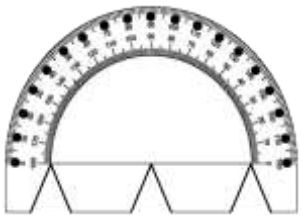

Figure (6) first attempt

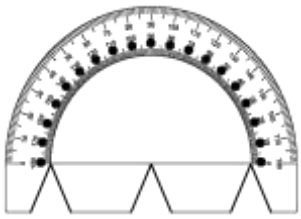

Figure (7) final shape

However, the position of these holes is not suitable for blind pupils because the drawing pins fell while moving the protractor. For that, holes were made in the inner edge of the protractor. Three holes were made in the middle of the protractor and zero degrees (fig. 7).

Ruler:

A typical plastic ruler was used after some modifications. These modifications were made after many different attempts, which can be shown in the following figures:

Figure (8) shows different attempts to produce rulers for blind pupils

- In the first attempt, a typical plastic ruler was used and made a gap in each centimeter on the ruler's edge, but this ruler can help pupils measure a line segment, not draw it.
- In the second attempt, a hole in each centimeter near the ruler edge was made. This ruler is good, but the ruler sometimes moves during drawing.
- In the third attempt, two holes at the beginning and the end of the ruler were made to fix it in the geometrical board before drawing.

Ruler in the Form of a Right Angle:

Figure (9) holes on the inner edge

Figure (10) Cutting the hypotenuse

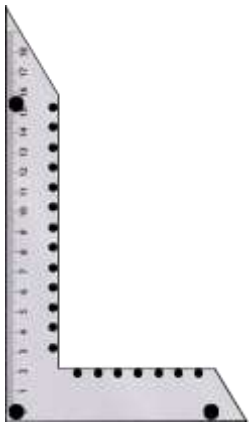

Figure (11) 3 big holes

The aim of constructing this ruler is to help the blind pupil draw the right angle easily. This ruler can be made as follows:

- Using a regular plastic right-angled triangle and made some holes on the inner edge of the triangle and the distance between each two of them = 1 cm (Figure9).
- Cutting the hypotenuse and completing the holes (figure 10).
- Making three big holes to fix it in the geometrical board before drawing (figure 11).

SAMPLES OF GEOMETRICAL OPERATIONS:

Drawing Line Segment:

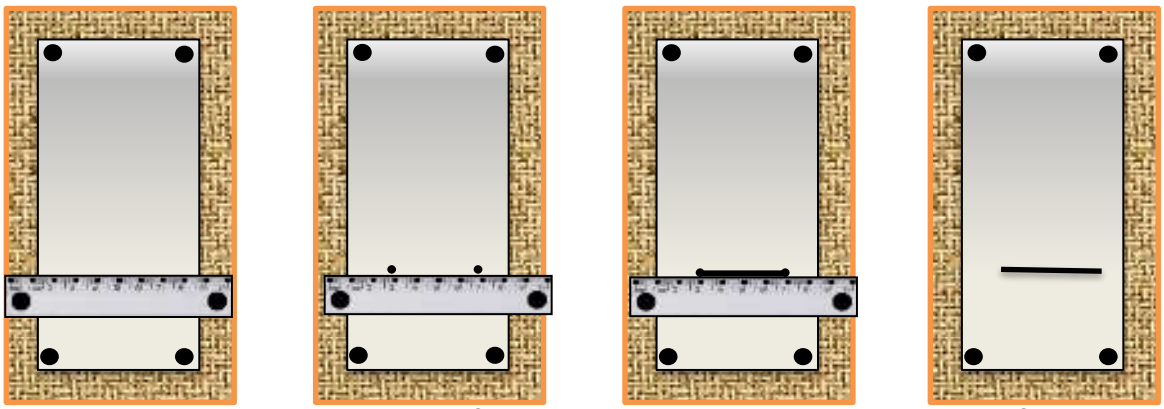

Figure (12) shows the steps of drawing line segments with a specific length

Fix the ruler on the board - determine the length using two drawing pins - then remove the ruler and pins. He/she can easily feel the line segment, as shown in the previous figure.

Drawing Rectangle:

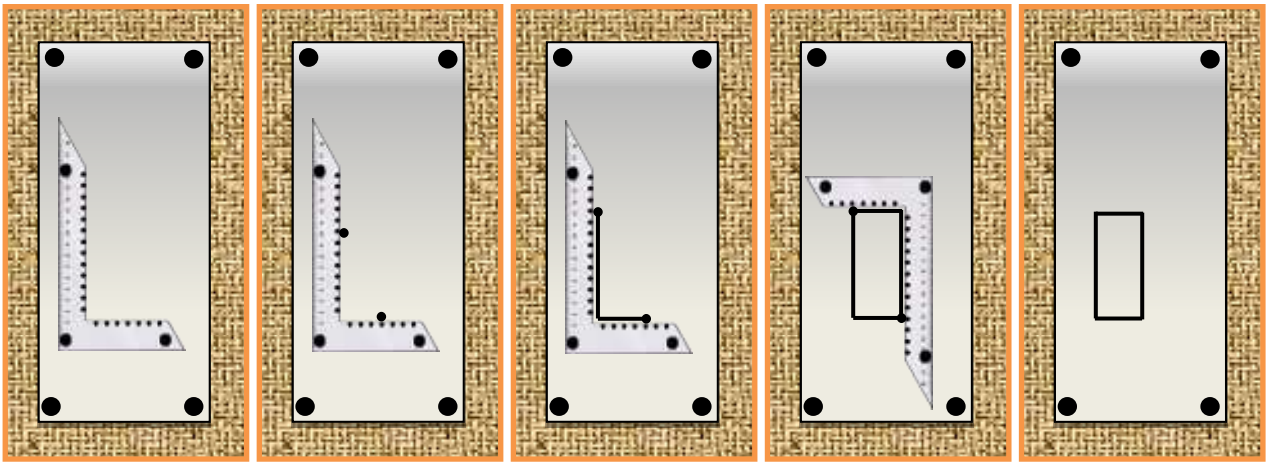

Figure (13) The steps of drawing rectangular

Fix the ruler on the board – put two drawing pines to determine the length and width of the rectangle. Draw the length and the width of the rectangle – Move the ruler to the opposite side and, fix it and complete drawing the rectangle – remove all the tools, then the pupil can feel each point in the rectangle.

The rectangle can also be quickly drawn by using two rulers as follows:

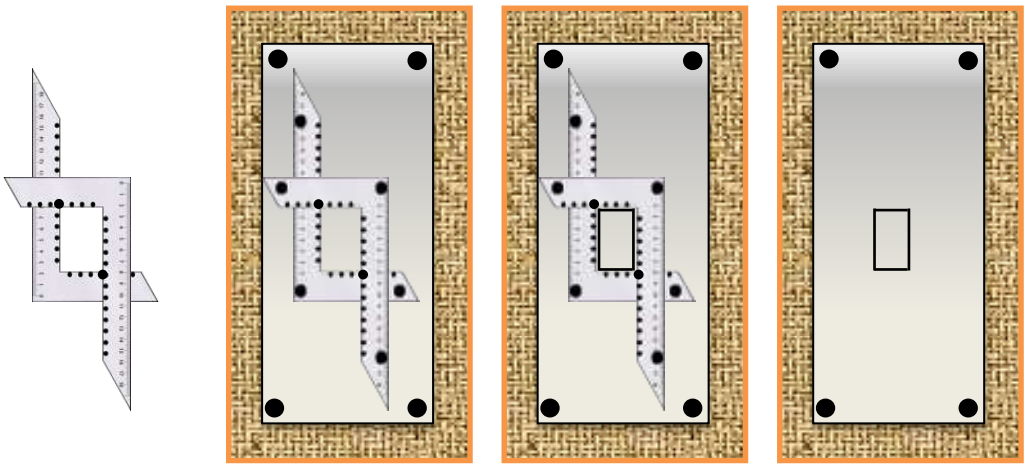

Figure (14) using two rulers to draw a rectangle

The previous figure shows that the blind pupil can determine the length and width of the rectangle on the two rulers, fix them on the board, and draw the rectangle easily**.**

Drawing Triangle:

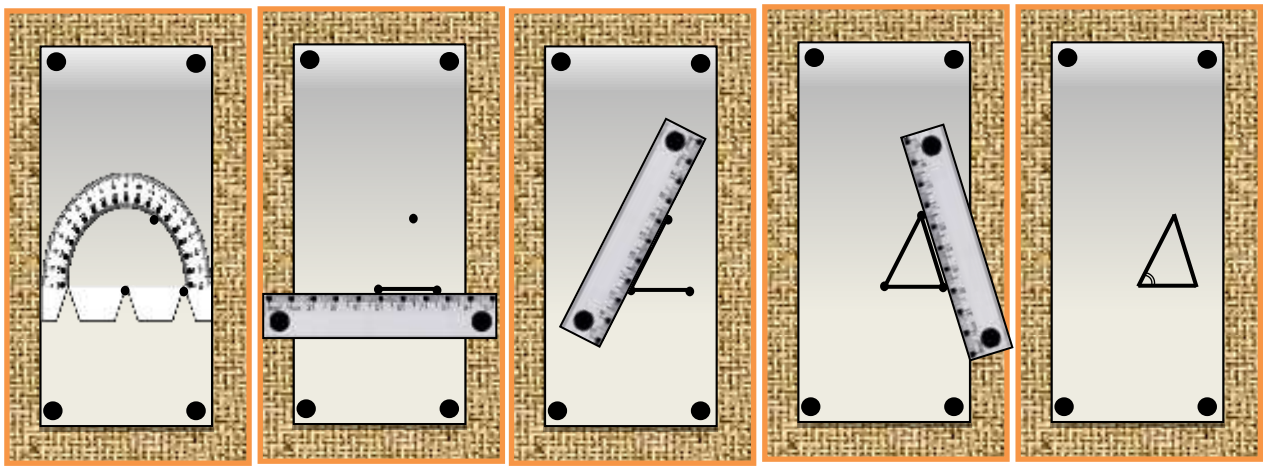

Figure (15) The steps of drawing a triangle

Put the protractor on the geometrical board and fix three drawing pins to determine three points in the angle – fix the ruler and draw the length of the first line segment – move the ruler and draw the second line segment for the angle with its length – draw the third line segment of the triangle - remove all the tools then the triangle appeared on the board.

THE RESULTS OF THE RESEARCH:

The results of the research can be shown in the following table:

No. of the pupil	The per cent of the score
1	86,1%
2	81,9%
3	72,2%
4	68,1%
5	55,6%
The mean	72,78%

Table (1) shows the scores of the pupils

The previous table shows that:

- All the pupils' samples get a mastery level in drawing the geometrical construction of more than 55%.

- The mean score of the pupils is 72,78%.
- The lowest score was 55,6% for the blind pupil (pupil no.5). These tools were suitable for the totally blind and visually impaired pupils.

RECOMMENDATIONS:

According to the results of this research, some recommendations can be presented as follows:

Development of drawing board:

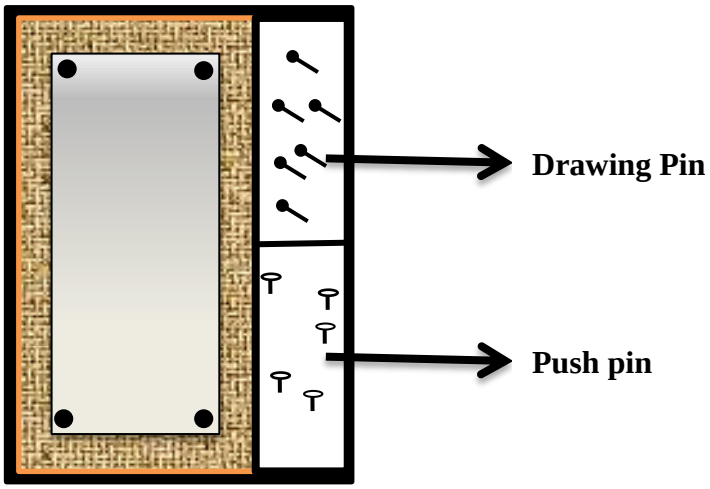

Figure (16) the development of the drawing board

The pupils put the drawings and push pins in their mouths during the research. To avoid that, this development can be made on the geometrical board by adding two magnetic boards to the board to attract the pins as shown in the previous figure.

Development of ruler:

Figure (17) shows the development of the ruler.

The ruler can be developed by adding two moving monitors to determine the length of a line segment before drawing it, as shown in the previous figure.

ACKNOWLEDGEMENT

The author would like to immensely thank Dr. Taha Ibrahim for his collaboration with her in drawing all the illustrations of this research. Profound thanks also go to Dr. Heba Mostafa and Dr. Mohamed Mekheimer for editing the language of this report.

References

Azevedo, A. C. & Santos, A. C. F. (2014). "Teaching Optics to Blind Pupils." ***Physics Education***, v49 n4 p383-386

Junthong, N, Netpradit, S. &Boonlue, S. (2020). The Designation of Geometry Teaching Tools for Visually Impaired Students Using Plastic Geoboards Created by 3D Printing. ***The New Educational Review.*** DOI:10.15804/tner.2020.59.1.07

Mostafa, M. (1981). A suggested method to teach art to blind girls. Theses of ***Master's Degree***, Faculty of Education, Helwan University, Egypt.

Pritchard, C. K.& Lamb, J. H. (2012)."Teaching geometry to the visually impaired student". ***Mathematics Teacher***, 106(1), 22–27.

Roth, P ; Petucci, L. & Pun, T. (2000)." "From Dots To Shapes": ***an auditory, haptic game platform for teaching geometry to blind pupils.*** The Swiss Priority Program finances the project in Information and Communication Structures.

Rouzierl, S.; Hennionl, B.; Segovial, T. P.; & Chene, D. (2004). " Touching geometry for visually impaired pupils." ***Proceeding of Euro Haptics Munich,*** *Germany*, 104-109.

Tanti, M. (2015).Teaching Mathematics To A Blind Student- A Case Study. Available at:

http://people.exeter.ac.uk/PErnest/pome20/Mariella%20Tanti%20Teaching%20Mathematics%20to%20a%20Blind%20Student%20%20%20%20%20%20A%20Case%20Study.pdf.

Vandana & Singla, A. (2022). Trends and Challenges in the World of The Blind for Education in Mathematics. ***Journal of Positive School Psychology***. vol.6, No. 4, 1213-1229