

DEGREES OF ACCESSIBILITY
ANNEXURES FILE

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ANNEXURE A: CONSENT FORMS

Consent Form (Adult)



Consent to Participate in a Research Study

XRCVC, Mumbai

Title of Study: Geometry Tools for the Blind

Investigator: Rebecca Carvalho

Name: _____

Phone

Number: _____

Introduction

You are being asked to participate in a research study of Geometry Tools for the Blind by the XRCVC, Mumbai.

You were selected as a possible participant because of you meeting our variables for the research (Gender, Disability Type & Age).

You are required to read this form and ask any questions that you may have before agreeing to be in the study.

Purpose of Study

The purpose of the study is to shortlist the key features for the ideal tools that can be used for Geometry study by blind students.

Ultimately, this research may be published as a publication or presented at a conference; this may include the use of your images at work and your feedback.

Description of the Study Procedures

If you agree to be in this study, you will be asked to do the following things:

1. Get trained by us to use the Geometry Tools & Methods that currently exist, such as the use of the different boards, rulers, protractors, compass or pins, to perform 6 key Geometry Skills identified.
2. You will be asked to perform each of the 6 skills independently as a Final Trial using different combinations of the Geometry tools and materials as listed in our research structure.

Observations will be made and a video recording of the same will be taken during the Training and Final Trial.

3. You would need to answer a detailed Questionnaire at the end of the Training and Final Trail for each of the 6 skills; as well as another final Questionnaire at the end of all 6 skills.

All of the above is expected to get completed over 7 four and a half hour sessions spread across different days.

Benefits of Being in the Study

The benefits of participation are that you will...

--Gain access to a wide range of Geometry tools and learn their usage

--Have contributed in developing a new user friendly design for Geometry tools in India.

Principles of the Research Study

The research will be guided by the following principles:

You are joining the study as a volunteer.

The decision to participate in this study is entirely up to you. However once you have signed this Consent Form and agreed to participate you are expected to complete the entire research as stated above and not withdraw or refuse to participate in any activity listed as this would affect the nature of the study.

Punctuality and regularity and communication for the same are expected for all the Research sessions.

You have the right to ask questions about this research study and to have those questions answered by the researcher before, during or after the research. If you have any further questions about the study, at any time feel free to contact me, Rebecca Carvalho at rebecca@xrcvc.org or by telephone at +91 22 22623298. If you like, a summary of the results of the study will be sent to you. If you have any other concerns about your rights as a research participant that have not been answered by the investigators, you may contact Dr Sam Taraporevala, Director, Xavier's Resource Centre for the Visually Challenged (XRCVC) at +91 22 22623298.

Consent

Your signature below indicates that you have decided to volunteer as a research participant for this study, and that you have read and understood the information provided above. You will be given a signed and dated copy of this form to keep.

Subject's Name: _____

Subject's Signature: _____

Date: _____

Investigator's
Signature:

Date: _____

Consent Form (Minors)



Minor Consent to Participate in a Research Study XRCVC, Mumbai

Title of Study: Geometry Tools for the Blind

Investigator: Rebecca Carvalho

Name: _____

Phone

Number: _____

Introduction

You are being asked to participate in a research study of Geometry Tools for the Blind by the XRCVC, Mumbai.

You were selected as a possible participant because of you meeting our variables for the research (Gender, Disability Type & Age).

You are required to read this form and ask any questions that you may have before agreeing to be in the study.

Purpose of Study

The purpose of the study is to shortlist the key features for the ideal tools that can be used for Geometry study by blind students.

Ultimately, this research may be published as a publication or presented at a conference; this may include the use of your images at work and your feedback.

Description of the Study Procedures

If you agree to be in this study, you will be asked to do the following things:

1. Get trained by us to use the Geometry Tools & Methods that currently exist, such as the use of the different boards, rulers, protractors, compass or pins, to perform 6 key Geometry Skills identified.
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You have the right to ask questions about this research study and to have those questions answered by the researcher before, during or after the research. If you have any further questions about the study, at any time feel free to contact me, Rebecca Carvalho at rebecca@xrcvc.org or by telephone at +91 22 22623298. If you like, a summary of the results of the study will be sent to you. If you have any other concerns about your rights as a research participant that have not been answered by the investigators, you may contact Dr Sam Taraporevala, Director, Xavier's Resource Centre for the Visually Challenged (XRCVC) at +91 22 22623298.

Consent

Your signature below indicates that you have decided to volunteer as a research participant for this study, and that you have read and understood the information provided above. You will be given a signed and dated copy of this form to keep.

Participant's Name: _____

Name & Signature of _____

Parent / Guardian / _____

Date: _____

Teacher:
Investigator's
Signature:

Date:

ANNEXURE B: PARTICIPANT REGISTRATION DETAILS**Geometry Tools Research – Batch ____****Place:** _____**Date:** _____

Name	Grade	Gender	City	Done Geometry before?	Braille literate?	Age	TB or LV
			Mumbai				
			Mumbai				
			Mumbai				
			Mumbai				
			Mumbai				

ANNEXURE C: TRAINING: RESEARCHER OBSERVATION FORMAT (SKILL 1-SKILL 6)

Skill 1: 6 Rulers

1. Exam Board + RNIB Ruler + with RNIB Pins
2. Exam Board + APH Ruler with Clip
3. Exam Board + Worth Trust Ruler + with RNIB Pins
4. Exam Board + Squirrel Ruler + with RNIB Pins
5. Draftsman Board + APH Draftsman Ruler + with RNIB Pins
6. Garg's kit

Skill 1: TRAINING

Start Time:

End Time:

With No. of Participants:

1. Combination: Exam Board + RNIB Ruler + with RNIB Pins

Number of Tries for Random Lines:

Number of Tries for Line Segments:

Throughout...

Aligning Sheet to Board & Immobilizing

Struggled

Got it easily

Comment:

Aligning Mat to Board

Struggled

Got it easily

NA

Comment:

Plotting Points

Struggled

Got it easily

Comment:

Measuring

Struggled

Got it easily

Comment:

Connecting the 2 points

Struggled

Got it easily

Comment:

At last Trial...

Got it right
Didn't Get it right
Didn't Get Because:

2. Exam Board + APH Ruler with Clip

Number of Tries for Random Lines:
Number of Tries for Line Segments:

Throughout...

Aligning Sheet to Board & Immobilizing

Struggled
Got it easily
Comment:

Aligning Mat to Board

Struggled
Got it easily
NA
Comment:

Throughout...

Plotting Points

Struggled
Got it easily
Comment:

Measuring

Struggled
Got it easily
Comment:

Connecting the 2 points

Struggled
Got it easily
Comment:

At last Trial...

Got it right
Didn't Get it right
Didn't Get Because:

3. Exam Board + Worth Trust Ruler + with RNIB Pins

Number of Tries for Random Lines:
Number of Tries for Line Segments:

Throughout...

Aligning Sheet to Board & Immobilizing

Struggled

Got it easily

Comment:

Aligning Mat to Board

Struggled

Got it easily

NA

Comment:

Throughout...

Plotting Points

Struggled

Got it easily

Comment:

Measuring

Struggled

Got it easily

Comment:

Connecting the 2 points

Struggled

Got it easily

Comment:

At last Trial...

Got it right

Didn't Get it right

Didn't Get Because:

4. Exam Board + Squirrel Ruler + with RNIB Pins

Number of Tries for Random Lines:

Number of Tries for Line Segments:

Throughout...

Aligning Sheet to Board & Immobilizing

Struggled

Got it easily

Comment:

Aligning Mat to Board

Struggled

Got it easily

NA

Comment:

Throughout...

Plotting Points

Struggled

Got it easily

Comment:

Measuring

Struggled

Got it easily

Comment:

Connecting the 2 points

Struggled

Got it easily

Comment:

At last Trial...

Got it right

Didn't Get it right

Didn't Get Because:

5. Draftsman Board + APH Draftsman Ruler + with RNIB Pins

Number of Tries for Random Lines:

Number of Tries for Line Segments:

Throughout...

Aligning Sheet to Board & Immobilizing

Struggled

Got it easily

Comment:

Aligning Mat to Board

Struggled

Got it easily

NA

Comment:

Throughout...

Plotting Points

Struggled

Got it easily

Comment:

Measuring

Struggled

Got it easily

Comment:

Connecting the 2 points

Struggled

Got it easily

Comment:

At last Trial...

Got it right

Didn't Get it right

Didn't Get Because:

6. Garg's kit

Number of Tries for Random Lines:

Number of Tries for Line Segments:

Throughout...

Aligning Sheet to Board & Immobilizing

Struggled

Got it easily

Comment:

Aligning Mat to Board

Struggled

Got it easily

NA

Comment:

Throughout...

Plotting Points

Struggled

Got it easily

Comment:

Measuring

Struggled

Got it easily

Comment:

Connecting the 2 points

Struggled

Got it easily

Comment:

At last Trial...

Got it right

Didn't Get it right

Didn't Get Because:

Skill 2: 5 Rulers + 3 Sheets

- | | | |
|-----------------------------------|----------------------------------|----------------------------------|
| 1. Thermoform + APH
Clip Ruler | 5. Parchment + APH Clip
Ruler | 9. Paper + APH Clip Ruler |
| 2. Thermoform + RNIB
Ruler | 6. Parchment + RNIB
Ruler | 10. Paper + RNIB Ruler |
| 3. Thermoform + Worth
Trust | 7. Parchment + Worth
Trust | 11. Paper + Worth Trust
Ruler |
| 4. Thermoform +
Squirrel Ruler | 8. Parchment + Squirrel
Ruler | 12. Paper + Squirrel
Ruler |
| | | 13. Paper + Garg Ruler |

SKILL 2: TRAINING

Start Time:

End Time:

With No. of Participants:

THERMOFORM + 4 Rulers

1. Thermoform + APH Clip Ruler

Number of Tries:

Finding the two end points

Struggled

Got it easily

Comment:

Aligning the ruler

Struggled

Got it easily

Comment:

Reading the Measurement

Struggled

Got it easily

Comment:

At last Trial...

Got it right

Didn't Get it right

Didn't Get Because:

2. Thermoform + RNIB Ruler

Number of Tries:

Finding the two end points

Struggled

Got it easily

Comment:

Aligning the ruler

Struggled

Got it easily

Comment:

Reading the Measurement

Struggled

Got it easily

Comment:

At last Trial...

Got it right

Didn't Get it right

Didn't Get Because:

3. Thermoform + Worth Trust Ruler

Number of Tries:

Finding the two end points

Struggled

Got it easily

Comment:

Aligning the ruler

Struggled

Got it easily

Comment:

Reading the Measurement

Struggled

Got it easily

Comment:

At last Trial...

Got it right

Didn't Get it right

Didn't Get Because:

4. Thermoform + Squirrel Ruler

Number of Tries:

Finding the two end points

Struggled

Got it easily

Comment:

Aligning the ruler

Struggled

Got it easily

Comment:

Reading the Measurement

Struggled

Got it easily

Comment:

At last Trial...

Got it right

Didn't Get it right

Didn't Get Because:

PARCHMENT + 4 RULERS

5. Parchment + APH Clip Ruler

Number of Tries:

Finding the two end points

Struggled

Got it easily

Comment:

Aligning the ruler

Struggled

Got it easily

Comment:

Reading the Measurement

Struggled

Got it easily

Comment:

At last Trial...

Got it right

Didn't Get it right

Didn't Get Because:

6. Parchment + RNIB Ruler

Number of Tries:

Finding the two end points

Struggled

Got it easily

Comment:

Aligning the ruler

Struggled

Got it easily

Comment:

Reading the Measurement

Struggled

Got it easily

Comment:

At last Trial...

Got it right

Didn't Get it right

Didn't Get Because:

7. Parchment + Worth Trust Ruler

Number of Tries:

Finding the two end points

Struggled

Got it easily

Comment:

Aligning the ruler

Struggled

Got it easily

Comment:

Reading the Measurement

Struggled

Got it easily

Comment:

At last Trial...

Got it right

Didn't Get it right

Didn't Get Because:

8. Parchment + Squirrel Ruler

Number of Tries:

Finding the two end points

Struggled

Got it easily

Comment:

Aligning the ruler

Struggled

Got it easily

Comment:

Reading the Measurement

Struggled

Got it easily

Comment:

At last Trial...

Got it right

Didn't Get it right

Didn't Get Because:

PAPER + 5 RULERS

9. Paper + APH Clip Ruler

Number of Tries:

Finding the two end points

Struggled

Got it easily

Comment:

Aligning the ruler

Struggled

Got it easily

Comment:

Reading the Measurement

Struggled

Got it easily

Comment:

At last Trial...

Got it right

Didn't Get it right

Didn't Get Because:

10. Paper + RNIB Ruler

Number of Tries:

Finding the two end points

Struggled

Got it easily

Comment:

Aligning the ruler

Struggled

Got it easily

Comment:

Reading the Measurement

Struggled

Got it easily

Comment:

At last Trial...

Got it right

Didn't Get it right

Didn't Get Because

11. Paper + Worth Trust Ruler

Number of Tries:

Finding the two end points

Struggled

Got it easily

Comment:

Aligning the ruler

Struggled

Got it easily

Comment:

Reading the Measurement

Struggled

Got it easily

Comment:

At last Trial...

Got it right

Didn't Get it right

Didn't Get Because:

12. Paper + Squirrel Ruler

Number of Tries:

Finding the two end points

Struggled

Got it easily

Comment:

Aligning the ruler

Struggled

Got it easily

Comment:

Reading the Measurement

Struggled

Got it easily

Comment:

At last Trial...

Got it right

Didn't Get it right

Didn't Get Because:

13. Paper + Garg Ruler

Number of Tries:

Finding the two end points

Struggled

Got it easily

Comment:

Aligning the ruler

Struggled

Got it easily

Comment:

Reading the Measurement

Struggled

Got it easily

Comment:

At last Trial...

Got it right

Didn't Get it right

Didn't Get Because:

Skill3: 6 Protractors

1. WT Protractor + WT Ruler
2. WT Protractor + RNIB Ruler
3. WT Protractor + APH Clip Ruler
4. RNIB Protractor + WT Ruler
5. RNIB Protractor + RNIB Ruler
6. RNIB Protractor + APH Clip Ruler
7. APH Wand Protractor
8. APH Wand-inside
9. Garg Protractor

Skill 3: TRAINING

Start Time:

End Time:

With No. of Participants:

1. WT Protractor + WT Ruler

Number of Tries:

Throughout...

Drawing the baseline

Struggled

Got it easily

Comment:

Aligning to the vertex & baseline

Struggled

Got it easily

Comment:

Measuring

Struggled

Got it easily

Comment:

Drawing the second arm

Struggled

Got it easily

Comment:

At last Trial...

Got it right

Didn't Get it right

Didn't Get Because:

2. WT Protractor + RNIB Ruler

Number of Tries:

Throughout...

Drawing the baseline

Struggled

Got it easily

Comment:

Aligning to the vertex & baseline

Struggled

Got it easily

Comment:

Measuring

Struggled

Got it easily

Comment:

Drawing the second arm

Struggled

Got it easily

Comment:

At last Trial...

Got it right

Didn't Get it right

Didn't Get Because:

3. WT Protractor + APH Clip Ruler

Number of Tries:

Throughout...

Drawing the baseline

Struggled

Got it easily

Comment:

Aligning to the vertex & baseline

Struggled

Got it easily

Comment:

Measuring

Struggled

Got it easily

Comment:

Drawing the second arm

Struggled

Got it easily

Comment:

At last Trial...

Got it right

Didn't Get it right

Didn't Get Because:

4. RNIB Protractor + WT Ruler

Number of Tries:

Throughout...

Drawing the baseline

Struggled

Got it easily

Comment:

Aligning to the vertex & baseline

Struggled

Got it easily

Comment:

Measuring

Struggled

Got it easily

Comment:

Drawing the second arm

Struggled

Got it easily

Comment:

At last Trial...

Got it right

Didn't Get it right

Didn't Get Because

5. RNIB Protractor + RNIB Ruler

Number of Tries:

Throughout...

Drawing the baseline

Struggled

Got it easily

Comment:

Aligning to the vertex & baseline

Struggled

Got it easily

Comment:

Measuring

Struggled

Got it easily

Comment:

Drawing the second arm

Struggled

Got it easily

Comment:

At last Trial...

Got it right

Didn't Get it right

Didn't Get Because:

6. RNIB Protractor + APH Clip Ruler

Number of Tries:

Throughout...

Drawing the baseline

Struggled

Got it easily

Comment:

Aligning to the vertex & baseline

Struggled

Got it easily

Comment:

Measuring

Struggled

Got it easily

Comment:

Drawing the second arm

Struggled

Got it easily

Comment:

At last Trial...

Got it right

Didn't Get it right

Didn't Get Because

7. APH Want Protractor

Number of Tries:

Throughout...

Drawing the baseline

Struggled

Got it easily

Comment:

Aligning to the vertex & baseline

Struggled

Got it easily

Comment:

Measuring

Struggled

Got it easily

Comment:

Drawing the second arm

Struggled

Got it easily

Comment:

At last Trial...

Got it right

Didn't Get it right

Didn't Get Because:

8. APH Wand-inside

Number of Tries:

Throughout...

Drawing the baseline

Struggled

Got it easily

Comment:

Aligning to the vertex & baseline

Struggled

Got it easily

NA

Comment:

Measuring

Struggled

Got it easily

Comment:

Drawing the second arm

Struggled

Got it easily

Comment:

At last Trial...

Got it right

Didn't Get it right

Didn't Get Because:

9. Garg Protractor

Number of Tries:

Throughout...

Drawing the baseline

Struggled

Got it easily

Comment:

Aligning to the vertex & baseline

Struggled

Got it easily

Comment:

Measuring

Struggled

Got it easily

Comment:

Drawing the second arm

Struggled

Got it easily

Comment:

At last Trial...

Got it right

Didn't Get it right

Didn't Get Because:

Skill 4: 5 Rulers + 3 Sheets

1. Thermoform sheet + WT protractor	4. Parchment sheet + WT protractor with pins	8. Paper + WT protractor with pins
2. Thermoform sheet + RNIB protractor with pins	5. Parchment sheet + WT protractor without pins	9. Paper + WT protractor without pins
3. Thermoform sheet + APH Wand Outside protractor	6. Parchment sheet + RNIB protractor with pins	10. Paper + RNIB protractor with pins
	7. Parchment sheet + APH Wand Outside protractor	11. Paper + APH Wand Outside protractor
		12. Paper + Garg protractor

Skill 4: TRAINING

Start Time:

End Time:

With No. of Participants:

THERMOFORM + 3 Protractor Methods**1. Thermoform sheet + WT protractor**

Number of Tries:

Aligning to baseline

Struggled

Got it easily

Comment:

Aligning to vertex

Struggled

Got it easily

Comment:

Reading the Measurement

Struggled

Got it easily

Comment:

At last Trial...

Got it right

Didn't Get it right

Didn't Get Because:

2. Thermoform sheet + RNIB protractor with pins

Number of Tries:

Aligning to baseline

Struggled

Got it easily

Comment:

Aligning to vertex

Struggled

Got it easily

Comment:

Reading the Measurement

Struggled

Got it easily

Comment:

At last Trial...

Got it right

Didn't Get it right

Didn't Get Because:

3. Thermoform sheet + APH Wand Outside protractor

Number of Tries:

Aligning to baseline

Struggled

Got it easily

Comment:

Aligning to vertex

Struggled

Got it easily

Comment:

Reading the Measurement

Struggled

Got it easily

Comment:

At last Trial...

Got it right

Didn't Get it right

Didn't Get Because:

PARCHMENT + 4 Protractor Methods

4. Parchment sheet + WT protractor with pins

Number of Tries:

Aligning to baseline

Struggled

Got it easily

Comment:

Aligning to vertex

Struggled

Got it easily

Comment:

Reading the Measurement

Struggled

Got it easily

Comment:

At last Trial...

Got it right

Didn't Get it right

Didn't Get Because:

5. Parchment sheet + WT protractor without pins

Number of Tries:

Aligning to baseline

Struggled

Got it easily

Comment:

Aligning to vertex

Struggled

Got it easily

Comment:

Reading the Measurement

Struggled

Got it easily

Comment:

At last Trial...

Got it right

Didn't Get it right

Didn't Get Because:

6. Parchment sheet + RNIB protractor with pins

Number of Tries:

Aligning to baseline

Struggled

Got it easily

Comment:

Aligning to vertex

Struggled

Got it easily

Comment:

Reading the Measurement

Struggled

Got it easily

Comment:

At last Trial...

Got it right

Didn't Get it right

Didn't Get Because:

7. Parchment sheet + APH Wand Outside protractor

Number of Tries:

Aligning to baseline

Struggled

Got it easily

Comment:

Aligning to vertex

Struggled

Got it easily

Comment:

Reading the Measurement

Struggled

Got it easily

Comment:

At last Trial...

Got it right

Didn't Get it right

Didn't Get Because:

PAPER + 5 Protractor Methods

8. Paper + WT protractor with pins

Number of Tries:

Aligning to baseline

Struggled

Got it easily

Comment:

Aligning to vertex

Struggled

Got it easily

Comment:

Reading the Measurement

Struggled

Got it easily

Comment:

At last Trial...

Got it right

Didn't Get it right

Didn't Get Because:

9. Paper + WT protractor without pins

Number of Tries:

Aligning to baseline

Struggled

Got it easily

Comment:

Aligning to vertex

Struggled

Got it easily

Comment:

Reading the Measurement

Struggled

Got it easily

Comment:

At last Trial...

Got it right

Didn't Get it right

Didn't Get Because:

10. Paper + RNIB protractor with pins

Number of Tries:

Aligning to baseline

Struggled

Got it easily

Comment:

Aligning to vertex

Struggled

Got it easily

Comment:

Reading the Measurement

Struggled

Got it easily

Comment:

At last Trial...

Got it right

Didn't Get it right

Didn't Get Because:

11. Paper + APH Wand Outside protractor

Number of Tries:

Aligning to baseline

Struggled

Got it easily

Comment:

Aligning to vertex

Struggled

Got it easily

Comment:

Reading the Measurement

Struggled

Got it easily

Comment:

At last Trial...

Got it right

Didn't Get it right

Didn't Get Because:

12. Paper + Garg protractor

Number of Tries:

Aligning to baseline

Struggled

Got it easily

Comment:

Aligning to vertex

Struggled

Got it easily

Comment:

Reading the Measurement

Struggled

Got it easily

Comment:

At last Trial...

Got it right

Didn't Get it right

Didn't Get Because:

Skill 5: 4 Compass

1. Classmate Compass + APH Clip Ruler + Parchment
2. Classmate Compass + RNIB ruler + Parchment
3. Classmate Compass + WT ruler + Parchment
4. Classmate Compass + Squirrel + Parchment
5. Worth Trust Ruler as a compass + Regular Pins + Parchment
6. APH Compass + Parchment
7. Garg Compass

SKILL 5: TRAINING

Start Time:

End Time:

With No. of Participants:

1. Classmate Compass + APH Clip Ruler + Parchment

Number of Tries for Free hand circles:

Number of Tries:

Throughout...**Fixing the radius**

Struggled

Got it easily

Comment:

Keeping one point fixed on the centre on circle when drawing

Struggled

Got it easily

Comment:

Drawing the complete circumference

Struggled

Got it easily

Comment:

At last Trial...

Got it right

Didn't Get it right

Didn't Get Because:

2. Classmate Compass + RNIB ruler + Parchment

Number of Tries for Free hand circles:

Number of Tries:

Throughout...

Fixing the radius

Struggled

Got it easily

Comment:

Keeping one point fixed on the centre on circle when drawing

Struggled

Got it easily

Comment:

Drawing the complete circumference

Struggled

Got it easily

Comment:

At last Trial...

Got it right

Didn't Get it right

Didn't Get Because:

3. Classmate Compass + WT ruler + Parchment

Number of Tries for Free hand circles:

Number of Tries:

Throughout...

Fixing the radius

Struggled

Got it easily

Comment:

Keeping one point fixed on the centre on circle when drawing

Struggled

Got it easily

Comment:

Drawing the complete circumference

Struggled

Got it easily

Comment:

At last Trial...

Got it right

Didn't Get it right

Didn't Get Because:

4. Classmate Compass + Squirrel + Parchment

Number of Tries for Free hand circles:

Number of Tries:

Throughout...

Fixing the radius

Struggled

Got it easily

Comment:

Keeping one point fixed on the centre on circle when drawing

Struggled

Got it easily

Comment:

Drawing the complete circumference

Struggled

Got it easily

Comment:

At last Trial...

Got it right

Didn't Get it right

Didn't Get Because:

5. Worth Trust Ruler as a compass + Regular Pins + Parchment

Number of Tries for Free hand circles:

Number of Tries:

Throughout...

Fixing the radius

Struggled

Got it easily

Comment:

Keeping one point fixed on the centre on circle when drawing

Struggled

Got it easily

Comment:

Drawing the complete circumference

Struggled

Got it easily

Comment:

At last Trial...

Got it right

Didn't Get it right

Didn't Get Because:

6. APH Compass + Parchment

Number of Tries for Free hand circles:

Number of Tries:

Throughout...

Fixing the radius

Struggled

Got it easily

Comment:

Keeping one point fixed on the centre on circle when drawing

Struggled

Got it easily

Comment:

Drawing the complete circumference

Struggled

Got it easily

Comment:

At last Trial...

Got it right

Didn't Get it right

Didn't Get Because:

7. Garg Compass

Number of Tries for Free hand circles:

Number of Tries:

Throughout...

Fixing the radius

Struggled

Got it easily

Comment:

Keeping one point fixed on the centre on circle when drawing

Struggled

Got it easily

Comment:

Drawing the complete circumference

Struggled

Got it easily

Comment:

At last Trial...

Got it right

Didn't Get it right

Didn't Get Because:

Skill 6: 4 Compass

1. Classmate Compass + Parchment
 2. Worth Trust Ruler as a compass + Regular Pins + Parchment
 3. APH Compass + Parchment
 4. Garg Compass + Braille Paper
- To draw line bisector use WT ruler*

SKILL 6: TRAINING

Start Time:

End Time:

With No. of Participants:

1. Classmate Compass

Number of Tries for Free hand arcs:

Number of Tries:

Throughout...**Fixing arm to left end of the line**

Struggled

Got it easily

Comment:

Fixing arm to right end of the line

Struggled

Got it easily

Comment:

Setting the radius

Struggled

Got it easily

Comment:

Drawing the arc from left end

Struggled

Got it easily

Comment:

Drawing the arc from right end

Struggled

Got it easily

Comment:

Finding point of intersection of two arcs**Drawing the line of bisection**

At last Trial...

Got it right

Didn't Get it right

Didn't Get Because:

2. Worth Trust Ruler as a compass with Regular Pins

Number of Tries for Free hand arcs:

Number of Tries:

Throughout...

Fixing arm to one end of the line

Struggled

Got it easily

Comment:

Setting the radius

Struggled

Got it easily

Comment:

Drawing the arc

Struggled

Got it easily

Comment:

Finding point of intersection of two arcs
--

Drawing the line of bisection

At last Trial...

Got it right

Didn't Get it right

Didn't Get Because:

3. APH Compass

Number of Tries for Free hand arcs:

Number of Tries:

Drawing the arc

Struggled

Got it easily

Comment:

Finding point of intersection of two arcs
--

Drawing the line of bisection

At last Trial...

Got it right

Didn't Get it right

Didn't Get Because:

4. Garg Compass

Number of Tries for Free hand arcs:

Number of Tries:

Drawing the arc

Struggled

Got it easily

Comment:

Finding point of intersection of two arcs

Drawing the line of bisection

At last Trial...

Got it right

Didn't Get it right

Didn't Get Because:

ANNEXURE D: TEST: RESEARCHER OBSERVATION FORMAT (SKILL 1-SKILL 6)
SKILL 1: FINAL TRIAL

Start Time:

End Time:

With No. of Participants:

1. Combination: Exam Board + RNIB Ruler + with RNIB Pins

Throughout...

Aligning Sheet to Board & Immobilizing

Struggled

Got it easily

Comment:

Aligning Mat to Board

Struggled

Got it easily

NA

Comment:

Plotting Points

Struggled

Got it easily

Comment:

Measuring

Struggled

Got it easily

Comment:

Connecting the 2 points

Struggled

Got it easily

Comment:

Given Measurement:

Measurement Got:

Right

Wrong

Wrong Because:

2. Exam Board + APH Ruler with Clip+ with RNIB Pins

Throughout...

Aligning Sheet to Board & Immobilizing

Struggled

Got it easily

Comment:

Aligning Mat to Board

Struggled

Got it easily

NA

Comment:

Plotting Points

Struggled

Got it easily

Comment:

Measuring

Struggled

Got it easily

Comment:

Connecting the 2 points

Struggled

Got it easily

Comment:

Given Measurement:

Measurement Got:

Right

Wrong

Wrong Because:

3. Exam Board + Worth Trust Ruler + with RNIB Pins

Throughout...

Aligning Sheet to Board & Immobilizing

Struggled

Got it easily

Comment:

Aligning Mat to Board

Struggled

Got it easily

NA

Comment:

Plotting Points

Struggled

Got it easily

Comment:

Measuring

Struggled

Got it easily

Comment:

Connecting the 2 points

Struggled

Got it easily

Comment:

Given Measurement:

Measurement Got:

Right

Wrong

Wrong Because:

4. Exam Board + Squirrel Ruler + with RNIB Pins

Throughout...

Aligning Sheet to Board & Immobilizing

Struggled

Got it easily

Comment:

Aligning Mat to Board

Struggled

Got it easily

NA

Comment:

Plotting Points

Struggled

Got it easily

Comment:

Measuring

Struggled

Got it easily

Comment:

Connecting the 2 points

Struggled

Got it easily

Comment:

Given Measurement:

Measurement Got:

Right

Wrong

Wrong Because:

5. Draftsman Board + APH Draftsman Ruler + with RNIB Pins

Throughout...

Aligning Sheet to Board & Immobilizing

Struggled

Got it easily

Comment:

Aligning Mat to Board

Struggled

Got it easily

NA

Comment:

Plotting Points

Struggled

Got it easily

Comment:

Measuring

Struggled

Got it easily

Comment:

Connecting the 2 points

Struggled

Got it easily

Comment:

Given Measurement:

Measurement Got:

Right

Wrong

Wrong Because:

6. Garg's kit

Throughout...

Aligning Sheet to Board & Immobilizing

Struggled

Got it easily

Comment:

Aligning Mat to Board

Struggled

Got it easily

NA

Comment:

Plotting Points

Struggled

Got it easily

Comment:

Measuring

Struggled

Got it easily

Comment:

Connecting the 2 points

Struggled

Got it easily

Comment:

Given Measurement:

Measurement Got:

Right

Wrong

Wrong Because:

SKILL 2: FINAL TRIAL

Start Time:

End Time:

With No. of Participants:

THERMOFORM + 4 Rulers

1. Thermoform + APH Clip Ruler

Finding the two end points

Struggled

Got it easily

Comment:

Aligning the ruler

Struggled

Got it easily

Comment:

Reading the Measurement

Struggled

Got it easily

Comment:

Given Measurement:

Measurement Got:

Right

Wrong

Wrong Because:

2. Thermoform + RNIB Ruler

Finding the two end points

Struggled

Got it easily

Comment:

Aligning the ruler

Struggled

Got it easily

Comment:

Reading the Measurement

Struggled

Got it easily

Comment:

Given Measurement:

Measurement Got:

Right

Wrong

Wrong Because:

3. Thermoform + Worth Trust Ruler

Finding the two end points

Struggled

Got it easily

Comment:

Aligning the ruler

Struggled

Got it easily

Comment:

Reading the Measurement

Struggled

Got it easily

Comment:

Given Measurement:

Measurement Got:

Right

Wrong

Wrong Because:

4. Thermoform + Squirrel Ruler

Finding the two end points

Struggled

Got it easily

Comment:

Aligning the ruler

Struggled

Got it easily

Comment:

Reading the Measurement

Struggled

Got it easily

Comment:

Given Measurement:

Measurement Got:

Right

Wrong

Wrong Because:

PARCHMENT + 4 Rulers

5. Parchment + APH Clip Ruler

Finding the two end points

Struggled

Got it easily

Comment:

Aligning the ruler

Struggled

Got it easily

Comment:

Reading the Measurement

Struggled

Got it easily

Comment:

Given Measurement:

Measurement Got:

Right

Wrong

Wrong Because:

6. Parchment + RNIB Ruler

Finding the two end points

Struggled

Got it easily

Comment:

Aligning the ruler

Struggled

Got it easily

Comment:

Reading the Measurement

Struggled

Got it easily

Comment:

Given Measurement:

Measurement Got:

Right

Wrong

Wrong Because:

7. Parchment + Worth Trust Ruler

Finding the two end points

Struggled

Got it easily

Comment:

Aligning the ruler

Struggled

Got it easily

Comment:

Reading the Measurement

Struggled

Got it easily

Comment:

Given Measurement:

Measurement Got:

Right

Wrong

Wrong Because:

8. Parchment + Squirrel Ruler

Finding the two end points

Struggled

Got it easily

Comment:

Aligning the ruler

Struggled

Got it easily

Comment:

Reading the Measurement

Struggled

Got it easily

Comment:

Given Measurement:

Measurement Got:

Right

Wrong

Wrong Because:

9. Paper + APH Clip Ruler

Finding the two end points

Struggled

Got it easily

Comment:

Aligning the ruler

Struggled

Got it easily

Comment:

Reading the Measurement

Struggled

Got it easily

Comment:

Given Measurement:

Measurement Got:

Right

Wrong

Wrong Because:

10. Paper + RNIB Ruler

Finding the two end points

Struggled

Got it easily

Comment:

Aligning the ruler

Struggled

Got it easily

Comment:

Reading the Measurement

Struggled

Got it easily

Comment:

Given Measurement:

Measurement Got:

Right

Wrong

Wrong Because:

11. Paper + Worth Trust Ruler

Finding the two end points

Struggled

Got it easily

Comment:

Aligning the ruler

Struggled

Got it easily

Comment:

Reading the Measurement

Struggled

Got it easily

Comment:

Given Measurement:

Measurement Got:

Right

Wrong

Wrong Because:

12. Paper + Squirrel Ruler

Finding the two end points

Struggled

Got it easily

Comment:

Aligning the ruler

Struggled

Got it easily

Comment:

Reading the Measurement

Struggled

Got it easily

Comment:

Given Measurement:

Measurement Got:

Right

Wrong

Wrong Because:

13. Paper + Garg Ruler

Finding the two end points

Struggled

Got it easily

Comment:

Aligning the ruler

Struggled

Got it easily

Comment:

Reading the Measurement

Struggled

Got it easily

Comment:

Given Measurement:

Measurement Got:

Right

Wrong

Wrong Because:

SKILL 3: FINAL TRIAL

Start Time:

End Time:

With No. of Participants:

1. WT Protractor + WT Ruler

Drawing the baseline

Struggled

Got it easily

Comment:

Aligning to the vertex & baseline

Struggled

Got it easily

Comment:

Measuring

Struggled

Got it easily

Comment:

Drawing the second arm

Struggled

Got it easily

Comment:

Given Measurement:

Measurement Got:

Right

Wrong

Wrong Because:

2. WT Protractor + RNIB Ruler

Drawing the baseline

Struggled

Got it easily

Comment:

Aligning to the vertex & baseline

Struggled

Got it easily

Comment:

Measuring

Struggled

Got it easily

Comment:

Drawing the second arm

Struggled

Got it easily

Comment:

Given Measurement:

Measurement Got:

Right

Wrong

Wrong Because:

3. WT Protractor + APH Clip Ruler

Drawing the baseline

Struggled

Got it easily

Comment:

Aligning to the vertex & baseline

Struggled

Got it easily

Comment:

Measuring

Struggled

Got it easily

Comment:

Drawing the second arm

Struggled

Got it easily

Comment:

Given Measurement:

Measurement Got:

Right

Wrong

Wrong Because:

4. RNIB Protractor + WT Ruler

Drawing the baseline

Struggled

Got it easily

Comment:

Aligning to the vertex & baseline

Struggled

Got it easily

Comment:

Measuring

Struggled

Got it easily

Comment:

Drawing the second arm

Struggled

Got it easily

Comment:

Given Measurement:

Measurement Got:

Right

Wrong

Wrong Because:

5. RNIB Protractor + RNIB Ruler

Drawing the baseline

Struggled

Got it easily

Comment:

Aligning to the vertex & baseline

Struggled

Got it easily

Comment:

Measuring

Struggled

Got it easily

Comment:

Drawing the second arm

Struggled

Got it easily

Comment:

Given Measurement:

Measurement Got:

Right

Wrong

Wrong Because:

6. RNIB Protractor + APH Clip Ruler

Drawing the baseline

Struggled

Got it easily

Comment:

Aligning to the vertex & baseline

Struggled

Got it easily

Comment:

Measuring

Struggled

Got it easily

Comment:

Drawing the second arm

Struggled

Got it easily

Comment:

Given Measurement:

Measurement Got:

Right

Wrong

Wrong Because:

7. APH Want Protractor

Drawing the baseline

Struggled

Got it easily

Comment:

Aligning to the vertex & baseline

Struggled

Got it easily

Comment:

Measuring

Struggled

Got it easily

Comment:

Drawing the second arm

Struggled

Got it easily

Comment:

Given Measurement:

Measurement Got:

Right

Wrong

Wrong Because:

8. APH Wand-inside

Drawing the baseline

Struggled

Got it easily

Comment:

Aligning to the vertex & baseline

Struggled

Got it easily

NA

Comment:

Measuring

Struggled

Got it easily

Comment:

Drawing the second arm

Struggled

Got it easily

Comment:

Given Measurement:

Measurement Got:

Right

Wrong

Wrong Because:

9. Garg Protractor

Drawing the baseline

Struggled

Got it easily

Comment:

Aligning to the vertex & baseline

Struggled

Got it easily

Comment:

Measuring

Struggled

Got it easily

Comment:

Drawing the second arm

Struggled

Got it easily

Comment:

Given Measurement:

Measurement Got:

Right

Wrong

Wrong Because:

SKILL 4: FINAL TRIAL

Start Time:

End Time:

With No. of Participants:

THERMOFORM + 3 Protractors

1. Thermoform sheet + WT protractor

Aligning to baseline

Struggled

Got it easily

Comment:

Aligning to vertex

Struggled

Got it easily

Comment:

Reading the Measurement

Struggled

Got it easily

Comment:

Given Measurement:

Measurement Got:

Right

Wrong

Wrong Because:

2. Thermoform sheet + RNIB protractor with pins

Aligning to baseline

Struggled

Got it easily

Comment:

Aligning to vertex

Struggled

Got it easily

Comment:

Reading the Measurement

Struggled

Got it easily

Comment:

Given Measurement:

Measurement Got:

Right

Wrong

Wrong Because:

3. Thermoform sheet + APH Wand Outside protractor

Aligning to baseline

Struggled

Got it easily

Comment:

Aligning to vertex

Struggled

Got it easily

Comment:

Reading the Measurement

Struggled

Got it easily

Comment:

Given Measurement:

Measurement Got:

Right

Wrong

Wrong Because:

PARCHMENT + 4 Protractors

4. Parchment sheet + WT protractor with pins

Aligning to baseline

Struggled

Got it easily

Comment:

Aligning to vertex

Struggled

Got it easily

Comment:

Reading the Measurement

Struggled

Got it easily

Comment:

Given Measurement:

Measurement Got:

Right

Wrong

Wrong Because:

5. Parchment sheet + WT protractor without pins

Aligning to baseline

Struggled

Got it easily

Comment:

Aligning to vertex

Struggled

Got it easily

Comment:

Reading the Measurement

Struggled

Got it easily

Comment:

Given Measurement:

Measurement Got:

Right

Wrong

Wrong Because:

6. Parchment sheet + RNIB protractor with pins

Aligning to baseline

Struggled

Got it easily

Comment:

Aligning to vertex

Struggled

Got it easily

Comment:

Reading the Measurement

Struggled

Got it easily

Comment:

Given Measurement:

Measurement Got:

Right

Wrong

Wrong Because:

7. Parchment sheet + APH Wand Outside protractor

Aligning to baseline

Struggled

Got it easily

Comment:

Aligning to vertex

Struggled

Got it easily

Comment:

Reading the Measurement

Struggled

Got it easily

Comment:

Given Measurement:

Measurement Got:

Right

Wrong

Wrong Because:

PAPER + 5 Protractors

8. Paper + WT protractor with pins

Aligning to baseline

Struggled

Got it easily

Comment:

Aligning to vertex

Struggled

Got it easily

Comment:

Reading the Measurement

Struggled

Got it easily

Comment:

Given Measurement:

Measurement Got:

Right

Wrong

Wrong Because:

9. Paper + WT protractor without pins

Aligning to baseline

Struggled

Got it easily

Comment:

Aligning to vertex

Struggled

Got it easily

Comment:

Reading the Measurement

Struggled

Got it easily

Comment:

Given Measurement:

Measurement Got:

Right

Wrong

Wrong Because:

10. Paper + RNIB protractor with pins

Aligning to baseline

Struggled

Got it easily

Comment:

Aligning to vertex

Struggled

Got it easily

Comment:

Reading the Measurement

Struggled

Got it easily

Comment:

Given Measurement:

Measurement Got:

Right

Wrong

Wrong Because:

11. Paper + APH Wand Outside protractor

Aligning to baseline

Struggled

Got it easily

Comment:

Aligning to vertex

Struggled

Got it easily

Comment:

Reading the Measurement

Struggled

Got it easily

Comment:

Given Measurement:

Measurement Got:

Right

Wrong

Wrong Because:

12. Paper + Garg protractor

Aligning to baseline

Struggled

Got it easily

Comment:

Aligning to vertex

Struggled

Got it easily

Comment:

Reading the Measurement

Struggled

Got it easily

Comment:

Given Measurement:

Measurement Got:

Right

Wrong

Wrong Because:

SKILL 5: FINAL TRIAL

Start Time:

End Time:

With No. of Participants:

1. Classmate Compass + APH Ruler

Fixing the radius

Struggled

Got it easily

Comment:

Keeping one point fixed on the centre on circle when drawing

Struggled

Got it easily

Comment:

Drawing the complete circumference

Struggled

Got it easily

Comment:

Given Measurement:

Measurement Got:

Right

Wrong

Wrong Because:

2. Classmate Compass + RNIB ruler

Fixing the radius

Struggled

Got it easily

Comment:

Keeping one point fixed on the centre on circle when drawing

Struggled

Got it easily

Comment:

Drawing the complete circumference

Struggled

Got it easily

Comment:

Given Measurement:

Measurement Got:

Right

Wrong

Wrong Because:

3. Classmate Compass + WT ruler

Fixing the radius

Struggled

Got it easily

Comment:

Keeping one point fixed on the centre on circle when drawing

Struggled

Got it easily

Comment:

Drawing the complete circumference

Struggled

Got it easily

Comment:

Given Measurement:

Measurement Got:

Right

Wrong

Wrong Because:

4. Classmate Compass + Squirrel

Fixing the radius

Struggled

Got it easily

Comment:

Keeping one point fixed on the centre on circle when drawing

Struggled

Got it easily

Comment:

Drawing the complete circumference

Struggled

Got it easily

Comment:

Given Measurement:

Measurement Got:

Right

Wrong

Wrong Because:

5. Worth Trust Ruler as a compass + Regular Pins

Fixing the radius

Struggled

Got it easily

Comment:

Keeping one point fixed on the centre on circle when drawing

Struggled

Got it easily

Comment:

Drawing the complete circumference

Struggled

Got it easily

Comment:

Given Measurement:

Measurement Got:

Right

Wrong

Wrong Because:

6. APH Compass

Fixing the radius

Struggled

Got it easily

Comment:

Keeping one point fixed on the centre on circle when drawing

Struggled

Got it easily

Comment:

Drawing the complete circumference

Struggled

Got it easily

Comment:

Given Measurement:

Measurement Got:

Right

Wrong

Wrong Because:

7. Garg Compass

Fixing the radius

Struggled

Got it easily

Comment:

Keeping one point fixed on the centre on circle when drawing

Struggled

Got it easily

Comment:

Drawing the complete circumference

Struggled

Got it easily

Comment:

Given Measurement:

Measurement Got:

Right

Wrong

Wrong Because:

SKILL 6: FINAL TRIAL

Start Time:

End Time:

With No. of Participants:

1. Classmate Compass**Fixing arm to one end of the line**

Struggled

Got it easily

Comment:

Setting the radius

Struggled

Got it easily

Comment:

Drawing the arc

Struggled

Got it easily

Comment:

Finding point of intersection of two arcs**Drawing the line of bisection****Given Measurement:****Measurement Got:****Right****Wrong****Wrong Because:****2. Worth Trust Ruler as a compass with Regular Pins****Fixing arm to one end of the line**

Struggled

Got it easily

Comment:

Setting the radius

Struggled

Got it easily

Comment:

Drawing the arc

Struggled

Got it easily

Comment:

Finding point of intersection of two arcs
--

Drawing the line of bisection

Given Measurement:

Measurement Got:

Right

Wrong

Wrong Because:

3. APH Compass

Fixing arm to one end of the line

Struggled

Got it easily

Comment:

Setting the radius

Struggled

Got it easily

Comment:

Drawing the arc

Struggled

Got it easily

Comment:

Finding point of intersection of two arcs
--

Drawing the line of bisection

Given Measurement:

Measurement Got:

Right

Wrong

Wrong Because:

4. Garg Compass

Fixing arm to one end of the line

Struggled

Got it easily

Comment:

Setting the radius

Struggled

Got it easily

Comment:

Drawing the arc

Struggled

Got it easily

Comment:

Finding point of intersection of two arcs
--

Drawing the line of bisection

Given Measurement:

Measurement Got:

Right

Wrong

Wrong Because:

**ANNEXURE E: GAME SIMULATION: RESEARCHER OBSERVATION FORMAT
(SKILL 1-SKILL 6)
SKILL 1: GAME**

Start Time:

End Time:

Choose the tools of your preference and construct a 4.5 cm or 5 inch line segment...

Exam Board + RNIB Ruler + with RNIB Pins

Exam Board + APH Ruler with Clip+ with RNIB Pins

Exam Board + Worth Trust Ruler + with RNIB Pins

Exam Board + Squirrel Ruler + with RNIB Pins

Draftsman Board + APH Draftsman Ruler + with RNIB Pins

Garg's kit

Other Observations:

SKILL 2: GAME

Start Time:

End Time:

Choose any of the 3 types of Tactile Graphic Line segment you would like to measure and choose a ruler with it...

1. Thermoform + APH Clip Ruler
2. Thermoform + RNIB Ruler
3. Thermoform + Worth Trust Ruler
4. Thermoform + Squirrel Ruler
5. Parchment + APH Clip Ruler
6. Parchment + RNIB Ruler
7. Parchment + Worth Trust Ruler
8. Parchment + Squirrel Ruler
9. Paper + APH Clip Ruler
10. Paper + RNIB Ruler
11. Paper + Worth Trust Ruler
12. Paper + Squirrel Ruler
13. Paper + Garg Ruler

Other Observations:

SKILL 3: GAME

Start Time:

End Time:

Choose the tools of your preference and construct a 45 degree angle...

WT Protractor + WT Ruler

WT Protractor + RNIB Ruler

WT Protractor + APH Clip Ruler

RNIB Protractor + WT Ruler

RNIB Protractor + RNIB Ruler

RNIB Protractor + APH Clip Ruler

APH Wand Protractor

APH Wand-inside

Garg Protractor

Other Observations:**SKILL 4: GAME**

Start Time:

End Time:

Choose any of the 3 types of Tactile Angles you would like to measure and choose a ruler with it...

1. Thermoform sheet + WT protractor
2. Thermoform sheet + RNIB protractor with pins
3. Thermoform sheet + APH Wand Outside protractor
4. Parchment sheet + WT protractor with pins
5. Parchment sheet + WT protractor without pins
6. Parchment sheet + RNIB protractor with pins
7. Parchment sheet + APH Wand Outside protractor
8. Paper + WT protractor with pins
9. Paper + WT protractor without pins
10. Paper + RNIB protractor with pins
11. Paper + APH Wand Outside protractor
12. Paper + Garg protractor

Other Observations:

SKILL 5: GAME

Start Time:

End Time:

Choose the tools of your preference and construct a 45 degree angle...

Classmate Compass + APH Clip Ruler + Parchment

Classmate Compass + RNIB ruler + Parchment

Classmate Compass + WT ruler + Parchment

Classmate Compass + Squirrel + Parchment

Worth Trust Ruler as a compass + Regular Pins + Parchment

APH Compass + Parchment

Garg Compass

Other Observations:

SKILL 6: GAME

Start Time:

End Time:

Choose the tools of your preference and construct a 45 degree angle...

Classmate Compass + Parchment

Worth Trust Ruler as a compass + Regular Pins + Parchment

APH Compass + Parchment

Garg Compass + Braille Paper

Other Observations:

ANNEXURE F: PARTICIPANT FEEDBACK QUESTIONNAIRE FORMAT (SKILL 1-SKILL 6)
SKILL 1: QUESTIONNAIRE

Start Time:

End Time:

Q1. Did you enjoy Constructing a Line Segment today?

Part 1: Board

Q2. Board you liked the most for this skill.	Why?
Board 1: APH Draftsman Board 2: Exam board Board 3: Garg's Board	
Q3. Board you liked the least for this skill.	Why?
Board 1: APH Draftsman Board 2: Exam board Board 3: Garg's Board	

Q4. Board you found the easiest for this skill.	Why?
Board 1: APH Draftsman Board 2: Exam board Board 3: Garg's Board	
Q5. Board you found the most difficult for this skill.	Why?
Board 1: APH Draftsman Board 2: Exam board Board 3: Garg's Board	

Part 1: Ruler

Q6. Ruler you liked the most for this skill.	Why?
Ruler 1: APH Draftsman Ruler Ruler 2: APH Clip Ruler Ruler 3: RNIB Ruler Ruler 4: Worth Trust Ruler Ruler 5: Squirrel Ruler Ruler 6: Garg's Ruler	

Q7. Ruler you liked the least for this skill.	Why?
Ruler 1: APH Draftsman Ruler Ruler 2: APH Clip Ruler Ruler 3: RNIB Ruler Ruler 4: Worth Trust Ruler Ruler 5: Squirrel Ruler Ruler 6: Garg's Ruler	
Q8. Ruler you found the easiest for this skill.	
Ruler 1: APH Draftsman Ruler Ruler 2: APH Clip Ruler Ruler 3: RNIB Ruler Ruler 4: Worth Trust Ruler Ruler 5: Squirrel Ruler Ruler 6: Garg's Ruler	
Q9. Ruler you found the most difficult for this skill.	
Ruler 1: APH Draftsman Ruler Ruler 2: APH Clip Ruler Ruler 3: RNIB Ruler Ruler 4: Worth Trust Ruler Ruler 5: Squirrel Ruler Ruler 6: Garg's Ruler	

Q10. Any other comment or feedback?

SKILL 2: QUESTIONNAIRE

Start Time:

End Time:

Q1. Did you enjoy Measuring a Line Segment today?**Part 1: Tactile Diagram Sheet**

Q2. Sheet you liked the most for this skill.	Why?
Sheet 1: Thermoform Sheet 2: Parchment Sheet 3: Braille Paper	
Q3. Sheet you liked the least for this skill.	Why?
Sheet 1: Thermoform Sheet 2: Parchment Sheet 3: Braille Paper	

Q4. Sheet you found the easiest for this skill.	Why?
Sheet 1: Thermoform Sheet 2: Parchment Sheet 3: Braille Paper	
Q5. Sheet you found the most difficult for this skill.	Why?
Sheet 1: Thermoform Sheet 2: Parchment Sheet 3: Braille Paper	

Part 2: Ruler

Q6. Ruler you liked the most for this skill.	Why?
Ruler 2: APH Clip Ruler Ruler 3: RNIB Ruler Ruler 4: Worth Trust Ruler Ruler 5: Squirrel Ruler Ruler 6: Garg's Ruler	
Q7. Ruler you liked the least for this skill.	Why?
Ruler 2: APH Clip Ruler Ruler 3: RNIB Ruler Ruler 4: Worth Trust Ruler Ruler 5: Squirrel Ruler Ruler 6: Garg's Ruler	
Q8. Ruler you found the easiest	

for this skill.	
Ruler 2: APH Clip Ruler Ruler 3: RNIB Ruler Ruler 4: Worth Trust Ruler Ruler 5: Squirrel Ruler Ruler 6: Garg's Ruler	
Q9. Ruler you found the most difficult for this skill.	
Ruler 2: APH Clip Ruler Ruler 3: RNIB Ruler Ruler 4: Worth Trust Ruler Ruler 5: Squirrel Ruler Ruler 6: Garg's Ruler	

Q10. Any other comment or feedback?

SKILL 3: QUESTIONNAIRE

Start Time:

End Time:

Q1. Did you enjoy Constructing an Angle today?

Part 1: Protractor

Q2. Protractor you liked the most for this skill.	Why?
Protractor 1: WT Protractor Protractor 2: RNIB Protractor Protractor 3: APH Wand Outside	

Protractor 4: APH Wand-inside Protractor 5: Garg Protractor	
Q3. Protractor you liked the least for this skill.	Why?
Protractor 1: WT Protractor Protractor 2: RNIB Protractor Protractor 3: APH Wand Outside Protractor 4: APH Wand-inside Protractor 5: Garg Protractor	

Q4. Protractor you found the easiest for this skill.	Why?
Protractor 1: WT Protractor Protractor 2: RNIB Protractor Protractor 3: APH Wand Outside Protractor 4: APH Wand-inside Protractor 5: Garg Protractor	
Q5. Protractor you found the most difficult for this skill.	Why?
Protractor 1: WT Protractor Protractor 2: RNIB Protractor Protractor 3: APH Wand Outside Protractor 4: APH Wand-inside Protractor 5: Garg Protractor	

Part 2: Ruler

Q6. Ruler you liked the most for this skill.	Why?
Ruler 2: APH Clip Ruler Ruler 3: RNIB Ruler Ruler 4: Worth Trust Ruler	
Q7. Ruler you liked the least for this skill.	Why?
Ruler 2: APH Clip Ruler Ruler 3: RNIB Ruler Ruler 4: Worth Trust Ruler	
Q8. Ruler you found the easiest for this skill.	
Ruler 2: APH Clip Ruler Ruler 3: RNIB Ruler Ruler 4: Worth Trust Ruler	
Q9. Ruler you found the most difficult for this skill.	
Ruler 2: APH Clip Ruler Ruler 3: RNIB Ruler Ruler 4: Worth Trust Ruler	

Q10. Any other comment or feedback?

SKILL 4: QUESTIONNAIRE

Start Time:

End Time:

Q1. Did you enjoy measuring angles today?**Part 1: Tactile Diagram Sheet**

Q2. Sheet you liked the most for this skill.	Why?
Sheet 1: Thermoform Sheet 2: Parchment Sheet 3: Braille Paper	
Q3. Sheet you liked the least for this skill.	Why?
Sheet 1: Thermoform Sheet 2: Parchment Sheet 3: Braille Paper	

Part 2: Protractor

Q6. Protractor you liked the most for this skill.	Why?
Protractor 1: Worth Trust Protractor Protractor 2: RNIB Protractor Protractor 3: APH Protractor with wand Protractor 4: Garg's Protractor	
Q7. Ruler you liked the least for this skill.	Why?

Q4. Sheet you found the easiest for this skill.	Why?
Sheet 1: Thermoform Sheet 2: Parchment Sheet 3: Braille Paper	
Q5. Sheet you found the most difficult for this skill.	Why?
Sheet 1: Thermoform Sheet 2: Parchment Sheet 3: Braille Paper	
Protractor 1: Worth Trust Protractor	

Protractor 2: RNIB Protractor Protractor 3: APH Protractor with wand Protractor 4: Garg's Protractor	
Q8. Protractor you found the easiest for this skill.	
Protractor 1: Worth Trust Protractor Protractor 2: RNIB Protractor Protractor 3: APH Protractor with wand Protractor 4: Garg's Protractor	
Q9. Protractor you found the most difficult for this skill.	
Protractor 1: Worth Trust Protractor Protractor 2: RNIB Protractor Protractor 3: APH Protractor with wand Protractor 4: Garg's Protractor	
Q10. Any other comment or feedback?	

SKILL 5: QUESTIONNAIRE

Start Time:

End Time:

Q1. Did you enjoy Constructing a circle today?**Part 1: Compass**

Q2. Compass you liked the most for this skill.	Why?
Compass 1: Classmate Compass 2: Worth Trust Ruler as a compass Compass 3: APH Compass Compass 4: Garg Compass	
Q3. Compass you liked the least for this skill.	Why?
Compass 1: Classmate Compass 2: Worth Trust Ruler as a compass Compass 3: APH Compass Compass 4: Garg Compass	

Q4. Compass you found the easiest for this skill.	Why?
Compass 1: Classmate Compass 2: Worth Trust Ruler as a compass Compass 3: APH Compass Compass 4: Garg Compass	
Q5. Compass you found the most difficult for this skill.	Why?
Compass 1: Classmate Compass 2: Worth Trust Ruler as a compass Compass 3: APH Compass Compass 4: Garg Compass	

When working with the Classmate compass...

Part 2: Ruler

Q6. Ruler you liked the most for this skill.	Why?
Ruler 2: APH Clip Ruler Ruler 3: RNIB Ruler Ruler 4: Worth Trust Ruler Ruler 5: Squirrel Ruler	

Q7. Ruler you liked the least for this skill.	Why?
Ruler 2: APH Clip Ruler Ruler 3: RNIB Ruler Ruler 4: Worth Trust Ruler Ruler 5: Squirrel Ruler	
Q8. Ruler you found the easiest for this skill.	
Ruler 2: APH Clip Ruler Ruler 3: RNIB Ruler Ruler 4: Worth Trust Ruler Ruler 5: Squirrel Ruler	
Q9. Ruler you found the most difficult for this skill.	
Ruler 2: APH Clip Ruler Ruler 3: RNIB Ruler Ruler 4: Worth Trust Ruler Ruler 5: Squirrel Ruler	

Q10. Any other comment or feedback?

SKILL 6: QUESTIONNAIRE

Start Time:

End Time:

Q1. Did you enjoy Bisecting a line segment today?**Part 1: Compass**

Q2. Compass you liked the most for this skill.	Why?
Compass 1: Classmate Compass 2: Worth Trust Ruler as a compass Compass 3: APH Compass Compass 4: Garg Compass	
Q3. Compass you liked the least for this skill.	Why?
Compass 1: Classmate Compass 2: Worth Trust Ruler as a compass Compass 3: APH Compass Compass 4: Garg Compass	

Q4. Compass you found the easiest for this skill.	Why?
Compass 1: Classmate Compass 2: Worth Trust Ruler as a compass Compass 3: APH Compass Compass 4: Garg Compass	
Q5. Compass you found the most difficult for this skill.	Why?
Compass 1: Classmate Compass 2: Worth Trust Ruler as a compass Compass 3: APH Compass Compass 4: Garg Compass	

Q6. Any other comment or feedback?

ANNEXURE G: TEACHING PEDAGOGY USED IN THE RESEARCH

Pre-Geometry Skill Orientation Training

Before starting Skill 1 training, a basic Pre-Geometry Orientation Training was conducted. The same involved the following:

- a. Orientation and Handling of Equipment
- b. Using of Board
- c. Learning how to Draw

a. Orientation and Handling of Equipment

Students were oriented and taught how to handle multiple tools whilst working.

- Students were given all the equipment (drawing board, rubber mat, packet of drawing sheets, etc.) in their hand one by one and asked to touch them.
- Students were also given a boxed tray with a box of pins, with the stylus placed inside, and asked to explore the same. The boxed tray ensured easy picking and using of material by preventing dropping and ensuring safety.
- Students were then oriented to the usage of each of the items given to them.
 - Drawing boards: Students were given all the boards in their hand one by one and asked to touch and explore the size and shape etc. Depending on the board given to the students, they were taught to identify the right orientation of the boards for use and the specific elements on the boards such as the clip/flaps.
 - Rubber Mat: Students were asked to touch the rubber mat with its silicon and foam surfaces. They were taught the feel of the right side of the mat with its smooth side facing up and the foam side facing downward.
 - Plastic Sheets: The students were instructed to touch the sheets.
 - Pins: Students were asked to explore the pins in the box safely through touch to ensure that they do not poke themselves with the pointed ends. Students were instructed that the pins had to be kept either in the pin box or inserted in the mat at all times, never lying on the table.
- Students were also asked to explore their workspace in front of them and asked to place the boxed tray at a place of their convenience.
- Students were also instructed to always put the material used back in its respective box to ensure easy finding and to prevent dropping.

b. Using the board

During the research, the students were taught to use three drawing boards- the Exam board, the Draftsman board and the Garg board.

- **Orientation to Board:**

Students were oriented to the right orientation of the board by touching the relevant parts of the respective boards.

- **Method used for Loading the sheet and mat in the board:**

For the Exam Board: Students were asked to align the sheet to the mat and touch to ensure that the sheet on the mat was correctly aligned within the mat's rectangular edges.

- Students were then asked to hold the sheet and mat together with one hand and slide them in the clip of the board by opening the clip with the other hand.

- After placing the sheet and mat inside the clip, the students were asked to check for gaps between the mat and the top edge of the clip. If there was any gap felt, they were asked to push the mat along with the paper all the way up.

For the Draftsman Board:



Figure 1: APH Draftsman Board with the clasps

Students were asked to feel the grooves on the left and right bottom edge of the board and asked to lift the clasps outwards on the left and right edges respectively.

- They were then asked to place a sheet on the board such that it was completely aligned to the top and the bottom of the mat and had equal spill over on the left and right edge of the mat.

For the Garg Board: Students were asked to lift the clip and keep it open, and use their hands to load the paper on the board, and feel the loaded paper on the board, and check that it is within the rectangular edges of the board.

- Once the paper was in position, they were asked to shut the clip. They were oriented to the tactual feedback of locking the paper in the board. The students were oriented to the magnet and hole making mechanism of the clip. This would ensure that if a paper had to be removed and put back it can be positioned in the same place.

- **Method used for immobilizing the sheet on the board:**

- For the Exam Board: Students were asked to push the sheet down gently with one hand from the top to the bottom of the mat to ensure that the paper is flat, and use their other hand to put three pins at the bottom of the page

starting at the left edge, then mid-way and finally, at the right edge of the paper such that it now remained immobilized, straight and flat on the mat.



Figure 2: Exam board with sheet, mat and the 3 immobilizing pins.

- *For the Draftsman Board:* Once the sheet was placed, the students were asked to press down the sheet and slide their hand towards the right edge of the board, and shut the right flap. After the sheet was immobilized on the right side, the students were again asked to slide their hands, towards the left side holding the sheet down to the mat, and then, close the left flap.
- *For the Garg Board:* With this board there was no additional immobilization of paper needed.

c. Learning how to Draw

- Students were asked to take the stylus from the boxed tray and keep the same at a 45-degree angle, and push against the immobilized sheet on the mat and for some freehand drawing practice. (They were shown this through physical demonstration). They were asked to feel the raised lines that were drawn.
- They were asked to practice drawing at that angle and with appropriate pressure till they got it right without tearing the paper or making too light a mark.

Skill 1: Constructing a Line Segment

For teaching the students the construction of a line segment, the following steps were followed:

- a. Explaining the concept of a line segment
- b. Orientation to the specific ruler (each different type)
- c. Finding the area to draw
- d. Teaching how to keep the ruler straight and centralized
- e. Plotting points and measuring
- f. Connecting the plotted points

a. Explaining the Concept of a Line Segment

Students were explained what a line segment is. Basic conceptual understanding of the topic was given.

b. Orientation to the Specific Ruler

- Students were given the specific ruler in their hand to explore. They were instructed to find the two ends of the ruler and feel them.
- Students were asked to explore the distinct edges of each of the rulers (e.g. the grooved side/ smooth side etc.).
- Students were to feel the markings on each of the rulers (e.g. long marks, extra-long marks, grooves, braille marks etc. and their meaning).
- Students were asked to feel any moving clips on the rulers, if applicable, and their functions were explained. In case of refreshable braille, students were explained the system.
- For the Squirrel ruler, they were explained the 16 parts and inch system of measurement.
- For the Draftsman ruler, they were oriented to the roller on the ruler and how to fix the roller on the Draftsman Board.

c. Finding the Area to Draw

- Students were asked to explore their immobilized sheet and find free space to draw on.

Free space was defined as an area with at least two finger empty space after anything tactile. (This free space was kept for labelling, which was not covered for the research).

d. Teaching how to keep the Ruler Straight and Centralized

- **Keeping the ruler straight:** Students were taught two methods to keep their rulers straight.

Method 1:

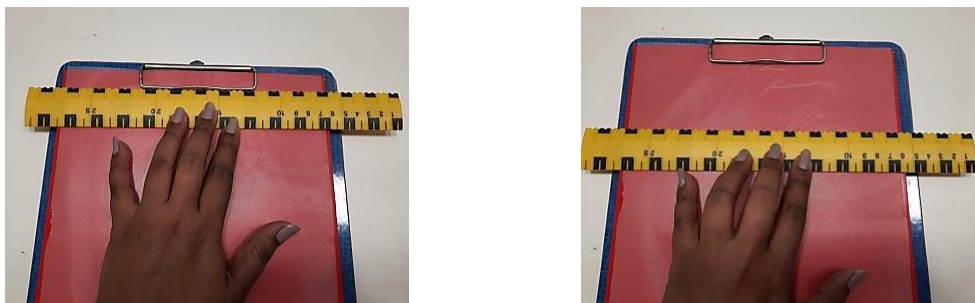


Figure 3: Method 1 of keeping the ruler straight

- Students were asked to take the ruler with the correct side (i.e. the grooved side of the RNIB ruler, and the cm side of the APH Clip ruler) towards the Exam board clip and touch it
- They were asked to re-check if the mat was fully inserted in the clip till the top edge of the board.
- They were then instructed to check if the ruler was entirely resting against the clip.
- They were then asked to bring the ruler down gradually (either with one or both hands) towards the area where they would draw. Once the ruler was placed in the drawing area, they were asked to hold the ruler down by stretching their non-dominant hand over the ruler.



Figure 4: Left hand spread out to hold the ruler in place post aligning the ruler

- For longer rulers, like the RNIB ruler and the APH Clip ruler, students could either keep the ruler aligned to the board clip in a way that equal amounts of the ruler lay outside the rubber mat on either side; or have it start at the left edge of the mat on one side with the extra part extending on the right side.

Method 2:



Figure 5: Method 2 of keeping the ruler straight

- Students were asked to take the left end of the ruler and place it in line with the left edge of the mat such that the two were in complete alignment without a gap; this could be confirmed by moving a finger along the left of the ruler and the mat.

- Once the alignment was done, they were asked to hold the ruler down by spreading their non-dominant hand over the ruler (as explained in Method 1 above).
- **Keeping the Ruler Centralized**



Figure 6: Ruler centralized to the page

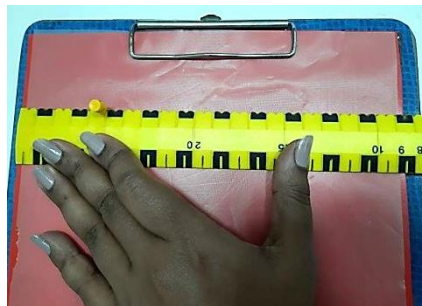


Figure 7: Position of ruler and start point pin to centralize the line segment

- Once the ruler was straight, students were asked to either push the ruler towards the centre of the page from the board clip or to leave some space from the left edge of the mat, or place a start point pin at a long mark after some space from the left edge of the mat.

Additional Points to be kept in mind.

- The Draftsman ruler was inserted in the slide grooves of the board, and the knob was tightened to keep the ruler both straight and immobilized. There was no centralization of the ruler since it covered the entire width of the board. Start points were centralized whilst plotting points.
- Given the size of the Squirrel ruler and its fixed clip on the left side, only Method 2 of aligning the ruler to the left edge of the board was useful in keeping the ruler straight.
- Similarly, since the WT ruler is smaller in length, only Method 1 of aligning as per the Board clip was advisable for keeping the ruler both straight and centralized.

e. Plotting Points and Measuring

● **Plotting the start point:**

- Depending on the ruler being used, the students were instructed to find the appropriate long mark or extra-long mark on the ruler to mark as the start point. Since the APH Clip ruler has no distinct 0 mark, the left edge of the ruler could also be used to plot the start point. For the Squirrel ruler, students were instructed that the left edge of the ruler would be the start point.
- Students were instructed to put a pin at the mark/groove if required and in the case of the Garg ruler, slide the point marker into the groove of the Garg ruler.

● **Measuring & plotting end point:**

- For counting whole numbers and decimals, the students were reminded of the specific marking system of each ruler that has been provided in the section of ruler orientation. They were reoriented with the marking system of each ruler and taught to distinguish between their full and half units of measurements.
- On counting the right measurement, they were asked to plot the end point by inserting the pin at the mark where the measurement ends whilst still continuing to hold down the ruler and resting it against the first pin whilst counting the measurement and inserting the pin for the end point.



Figure 8: Plotting of end point pin

- When using the Garg ruler, a few additional steps were involved. Unlike the others where points were marked by inserting the pins in the mats, for Garg ruler once the ruler was placed in the right position, point markers of the Garg kit were slid into the grooves of the ruler. The point markers and the ruler had magnet below making them stay in position. After the students had marked both points, by sliding the point markers into positions, they were then asked to remove the ruler from the board and place the paper back on the point markers. They were instructed to gently find the point from top of the paper and press down around the

point such that both points were punctured in the paper to mark the two end points of the line segment.



Figure 9: Plotting of start and end point on the Garg board

- When using the APH Clip ruler, after counting the right measurement, the students were asked to bring the clip to the mark where the measurement completed. They were instructed to keep their finger at the end point mark and bring the clip to that point with their other hand.



Figure 10: Plotting of end point with the APH clip ruler

- For the Squirrel ruler, the students simply had to drag the clip along the length of the ruler to the desired measurement while reading the measurement on the refreshable braille clip.



Figure 11: Plotting of end point with the Squirrel ruler

f. Connecting the Plotted Points

- Students were asked to turn the ruler to the smooth side when using the Draftsman and the RNIB rulers. The Draftsman ruler then had to be placed on the Draftsman board touching the plotted end point pins with the smooth side, and then fixed along the right edge of the board by tightening the screw. They were then asked to confirm if the ruler was touching the plotted end point pins, and adjust the placement, if required.

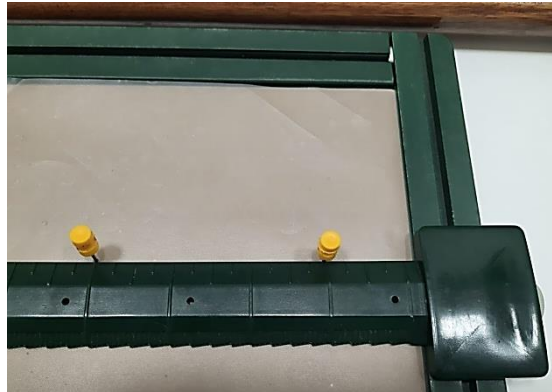


Figure 12: Smooth edge of Draftsman ruler touching plotted point pins

- They were then asked to use the stylus and draw from pin to pin .
- For the clip rulers, once the moving clip was in the place of the end point, the students were asked to draw from the start point to the end point clip whilst continuing to hold down the ruler with one hand.



Figure 13: Connecting plotted points with the Squirrel ruler

- For the Garg ruler: At this point, they were oriented to the line marker, the groove on it, as well as the bridge. They were instructed that the bridge could be removed if the line being drawn is a very short line.

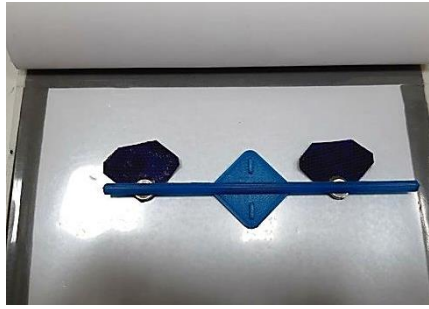


Figure 14: Connecting plotted points on the Garg board

- They were oriented to the placing of the line marker on the two points. After it was placed, they were asked to put the paper back down on the line marker resting on the point markers. With their hand placed gently on the braille paper, they were asked to lightly feel the line marker through the paper, starting from the start point to the end point.

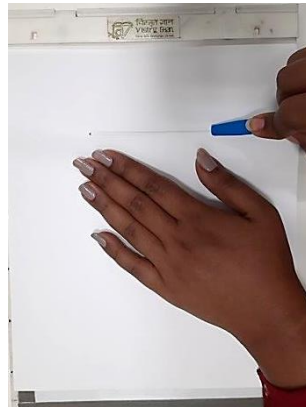


Figure 15: Drawing a line on the Garg board

- They were oriented to the **Garg** stylus and explained about the groove on the stylus. They were instructed to go to the start point and rest the groove of the stylus on the line marker from above the braille paper, and ensure a good grip at the start point. Holding the stylus face down on the line marker, they were taught to drag the stylus towards the end point to draw a line segment whilst simultaneously using the other hand to hold onto the line marker from above the paper at the start point and the end point so that it does not move when the line is being drawn.
- Some students found it easier to turn the board horizontally (and draw the line segment vertically) to have a better hold and were permitted to do so.

Skill 2: Measuring a Line Segment

For teaching measuring of a line segment, the following steps were followed

- a. Revision of the concept of a line segment and introduction to the skill of measuring lines
- b. Orientation to TDs and use of a ruler to measure a line segment on each type of TD, as applicable
- c. Finding the two end points
- d. Aligning the ruler to the line segment
- e. Reading the measurement

a. Revision of the Concept of a Line Segment and Introduction to the Skill of Measuring Lines

The concept of a line segment was revised. Students were informed that in this skill, unlike drawing in the earlier one, they would be given TDs of line segments and they would have to measure the same.

b. Orientation to TDs and Use of a Ruler to Measure a Line Segment on each type of TD, as applicable

Students were oriented to use the Thermoform Sheet, Plastic Sheet and Braille Paper TDs with the RNIB Ruler, the APH Clip Ruler, the WT Ruler and the Squirrel Ruler and the Braille Paper TD with the Garg Ruler. The method used in orienting the student to the TDs and the use of ruler for measuring the line segment was as follows:

- **Handing over of the Board:** Students were handed over the Exam Board
- **Handing over and Orientation to TDs:**
 - Students were explained that there were 3 types of TDs that were being used for this skill – Thermoform Sheet, Plastic Sheet and Braille Paper TDs. They were informed about the sheet being handed over to them.
 - When using the Thermoform Sheet TDs and Braille Paper TDs, students were expected to immobilize the sheet only using the Exam Board clip at the top, and no pins at the bottom of the sheet, as was done with the Exam Board Drawing Kit in Skill 1.
 - For Plastic Sheet TDs, students were asked to immobilize the sheets using the Exam Board clip at the top, and also pins at the bottom, as was done in Skill 1 with the Exam Board Drawing Kit.
 - On the Garg Drawing Board, they immobilized the Braille paper, as done in Skill 1.
- **Handing over of the Ruler and Revision of the Ruler:** Students were handed over the different types of rulers and were given a quick revision of the rulers and their measurement systems.

c. Finding the Two End Points

This section details the rules for finding the two end points for when using the APH clip ruler, the RNIB ruler, the WT ruler and the Squirrel ruler in combination with the Thermoform sheet, the Plastic sheet and the Braille paper TDs.

- For Thermoform sheet TDs, students were asked to touch and locate the line segment, and identify the two end points for the same.
- For Braille paper and Plastic sheet TDs, students were asked to touch and locate the line segment, and identify the two end points for the same. They were also asked to insert pins exactly at the start point and end point as the tactile lines on the Plastic and Braille paper sheets since they were not high enough to be felt once rulers were aligned to them for measurement.
- For the Garg Kit, after students loaded their Braille paper TD on the Garg board they were asked to touch and locate the line segment and identify the two end points for the same. They were then asked to lift the paper slightly, and whilst keeping their finger at the start point, use the other hand to place a point marker underneath the paper exactly under the start point. They were asked to do the same for the end point.

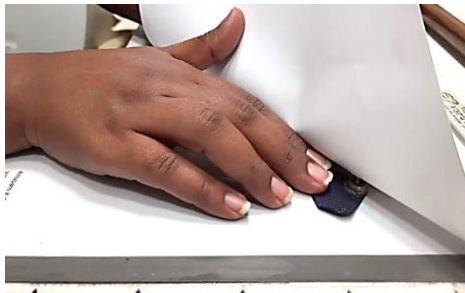


Figure 16: Finding the two end points with the Garg board

- They were then asked to place the paper over the point markers, and gently touch the alignment, and only when confident punch the two holes by puncturing at the point markers.



Figure 17: Puncturing holes at the end points with the Garg board

d. **Aligning the Ruler to the Line Segment**

- Students were asked to place the rulers just below the line segment such that it was completely touching the line without any gap in between the ruler and the line. They were asked to align the ruler as follows: the cm side up for the APH Clip ruler, the grooved side up for the RNIB ruler, the semi-circle to the left side for WT ruler, and the moving clip side up for the Squirrel ruler.
- Students were then asked to position the ruler in the following manner for each type of ruler:
 - **For the APH Clip Ruler:** They could either place the left edge of the ruler, or any long mark of the ruler at the start point. They were to hold down the ruler with one hand and use the other hand to bring the clip of the ruler to the end point, or to measure the length of the line segment with a finger on the tactile markings itself (without the clip).

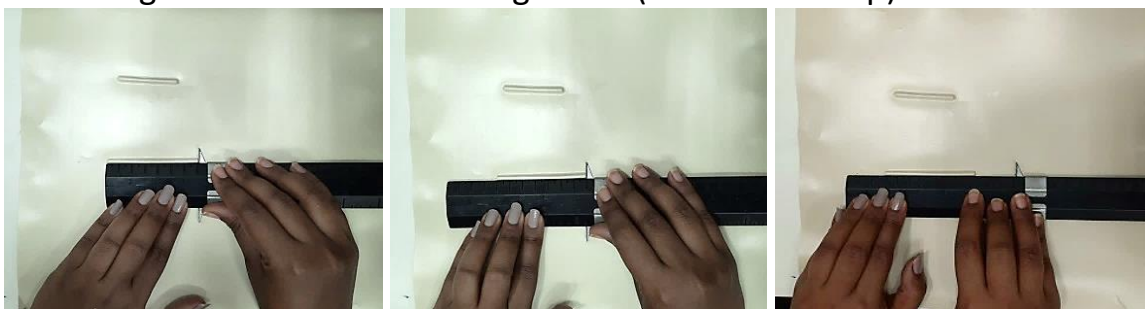


Figure 18: Aligning the APH clip Ruler to the line segment – 3 methods

- **For the RNIB Ruler:** When using the Thermoform sheet, the students could either place the left edge of the ruler, or any long mark of the ruler at the start point. When using the Plastic and Braille paper sheets, they were asked to place one pin each at the start point and end point of the line segment. Then, they were supposed to align the ruler to the line segment such that either a groove of a long mark or an extra-long mark was at the start point. Finally, they were supposed to hold down the ruler with one hand, and measure with the other till the long mark or extra-long mark at the end point.
- **For the WT Ruler:** They could either place any long mark, or the left edge of the ruler after the semi-circle at start point. They were to hold down the ruler and measure with their other hand either till the end point. Some students chose to immobilize the ruler after alignment.
- **For the Squirrel Ruler:** Students were asked to push the moving clip to the right most end of the ruler and rest the ruler along the length of the line. They were then asked to slide the ruler to the right till the fixed clip

corner fitted fully at the start point of the line. They were then asked to push the moving clip back to the left up to the end point of the line.



Figure 19: Aligning the Squirrel ruler to the line segment

- **For the Garg Ruler:** In combination with the Braille paper TDs,
 - After puncturing the holes in the Braille paper, they were asked to lift the paper and press it down on the clip of the board.



Figure 20: Paper pressed down onto the clip on the Garg board, thus making visible the point markers and ruler that were previously under the paper.

- They were asked to bring the groove side of the ruler and place the start point at either the first groove on the ruler or any long mark and after this rest the ruler against the second point marker

e. Reading the Measurement

- **For the RNIB and the WT rulers,** students were asked to use one hand to count the measurement by touching and counting the tactile markings, whilst holding down the ruler aligned to the start and end points with their other hand.
- **For the APH Clip ruler,** students were asked to either count the tactile markings, or to read the braille closest to the end point and count the remaining markings to complete their measurement.
- **For the Squirrel ruler,** students were asked to either count up to the last mark before/at the end point, or read the braille closest to the end point, followed by reading the refreshable braille for the decimal measurement following the whole number measurement they would have got by the mark/fixed braille reading.

- **For the Garg ruler**, they were asked to measure the marks between the two end points of the line segment whilst holding down the ruler to arrive at the final measurement.

Skill 3: Constructing an Angle

For teaching the construction of an angle, the following steps were followed:

- a. Explaining the concept of an angle and orientation to and use of different protractors
 - b. Finding the area to draw
 - c. Drawing of the baseline
 - d. Finding the vertex and aligning to the vertex and baseline (RNIB, WT Protractor)
 - e. Reading the measurement and plotting the point and drawing the second arm (RNIB, WT Protractor)
 - OR
 - f. Drawing the angle (APH wand Protractor, APH Wand-inside Protractor, Garg Protractor)
- a. **Explaining the Concept of an Angle and Orientation to and Use of different Protractors**
 - Students were given an explanation of what an angle is with basic theory concepts to ensure that they understand the concept clearly. They were explained the concepts of rays, vertex etc.
 - Students were then oriented to different protractors. For each protractor, they were shown the marking system as well as the specific component relevant to each protractor individually. They were made to explore the shape, components e.g. wands, base of the protractor, degree markings and any short cut markings if applicable.
 - b. **Finding the Area to Draw**
 - Students were asked to explore their immobilized sheet and find free space to draw on.
Free space was defined as an area with at least a palm-size empty space after anything tactile. This rule was in place to keep space for drawing the second arm.
 - Students were also told to always start drawing the baseline after keeping one palm space from the left end of the board
 - c. **Drawing of the Baseline**
 - **For the RNIB and the WT Protractors**, WT Ruler, APH Clip Ruler and RNIB Rulers were used to draw the baseline using the same method as drawing a line segment in Skill 1 using these rulers, except for using pins for plotting end points. The students were informed that they could draw freely along the ruler as the baseline need not have end points and they could draw it as long as they liked.

d. **Finding the Vertex and Aligning to the Vertex and Baseline**

- **WT Protractor:** Students were asked to locate the left end point of the base arm, i.e. the vertex, and put a pin exactly at the vertex.
 - They were then asked to keep the WT protractor straight and align the 3rd tip at the bottom-centre of the protractor exactly to the vertex pin and keep the 4th and 5th tip exactly on the base arm. They were shown, through touch, that the 3rd tip should be on top of the vertex pin and not to its left or right. They were also instructed that the 4th and 5th tips should neither be above the base arm nor overlap the base arm, but resting against the base arm.
 - They were then asked to immobilize the protractor by inserting pins in the immobilization holes. Some students chose to not immobilize the protractor, and continued to the next step.

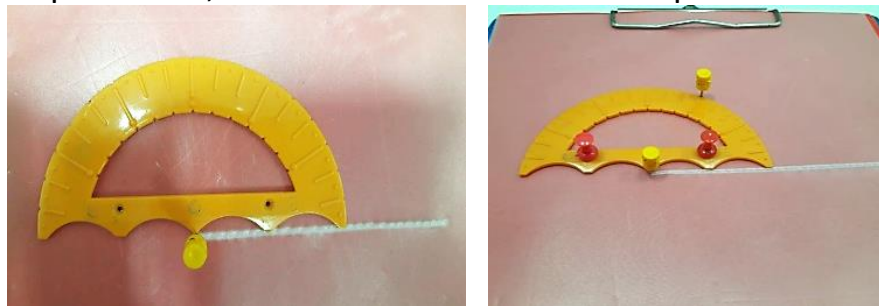


Figure 21: Aligning the WT protractor to the vertex and baseline

- **RNIB Protractor:** Students were asked to locate the left end point of the base arm i.e. the vertex and put a pin exactly at the vertex.
 - They were then shown the RNIB knob and asked to touch the cone shape of the RNIB knob, and instructed that the broader part of the cone shaped knob is always to be placed against the surface of the sheet. They were then shown how to insert the knob on the vertex pin and asked to place it on the vertex pin.
 - They were then asked to place the protractor such that the semi-circle indent/notch at the bottom-centre of the protractor was placed exactly on the knob along with the right edge of the protractor resting on baseline and not away from the baseline or overlapping the baseline. They were also instructed that the protractor should not go underneath the knob and use their fingers to confirm that the knob is always resting on the mat.

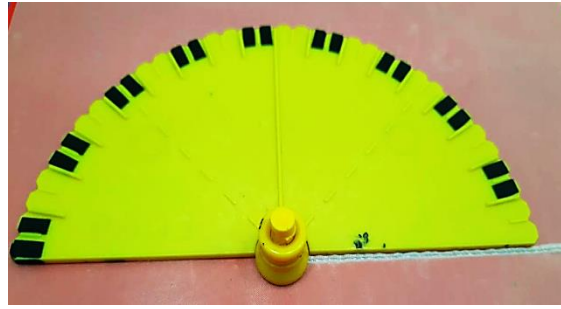


Figure 22: Aligning the RNIB protractor to the vertex and baseline

- e. **Reading the Measurement and Plotting the Point and Drawing the Second Arm**
- Students were asked to measure the degrees starting from the right end of the protractor keeping in mind the specific measurement systems of the protractors.
 - Once they had found the desired measurement the students were instructed to place a pin at the measurement mark.
 - For Drawing the second arm,
 - **Worth Trust Protractor:** Before drawing the second arm the students were asked to remove the WT protractor the immobilization pins along and remove the WT protractor without removing or moving the vertex and measurement pins.

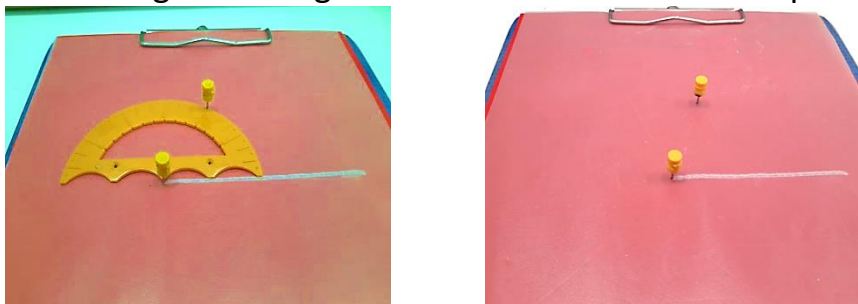


Figure 23: Plotting points for drawing the second arm with the WT protractor

- **For the RNIB protractor,** students were asked to remove the protractor and the knob from the vertex pin without removing the vertex and 45-degree measurement mark pins. Rulers were then used to draw the second arm. The method for using the ruler to draw the second arm is mentioned below:
- **WT Ruler:** The students were asked to take the WT ruler from the left side/behind the pins, and rest it against both the vertex and 45-degree measurement mark pins. After checking if the ruler was resting on both pins, they were asked to hold down the ruler with the left hand, and connect the two points by drawing a line with a stylus.

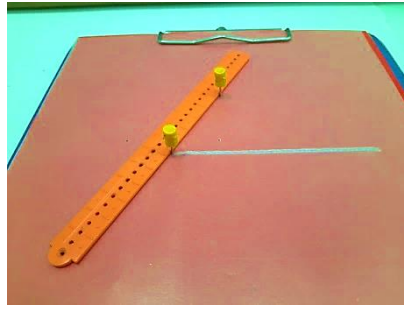


Figure 24: Drawing the second arm

- **APH Clip Ruler:** The students were asked to shift the clip on the right edge of the ruler or remove it completely. They were then asked to take the ruler and rest it on both the vertex and 45-degree measurement mark pins from the left side/behind the pins. After checking if the ruler was resting on both pins, they were asked to hold down the ruler with the left hand, and connect the two points by drawing a line with a stylus.
 - **RNIB Ruler:** They were asked to take the ruler and rest its smooth edge on both the vertex and 45-degree measurement mark pins from the left side/behind the pins. After checking if the ruler was resting on both pins, they were asked to hold down the ruler with the left hand, and connect the two points by drawing a line with a stylus.
 - After they completed drawing the line, they were asked to take away the ruler, remove the pins, and touch the angle drawn.
- f. **Drawing the Angle**
- **APH Wand Protractor:** Students were asked to measure the degrees starting from the right end of the protractor and once they had found the desired measurement align the pointed end of the wand to the measurement, hold the wand down and tighten the knob.

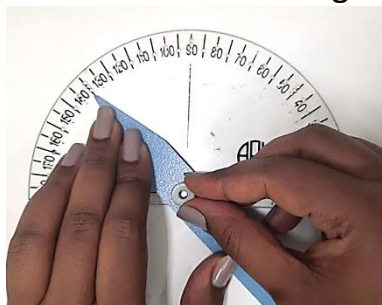


Figure 25: Setting the measurement on the APH Wand protractor

- Students were asked to keep the protractor completely upside down (such that the wand was up and the protractor down), and centralized in their drawing area.



Figure 26: Drawing the angle with the APH Wand protractor

- They were also instructed to keep the base of the protractor as straight as possible once turned upside down.
- They were then asked to hold down the protractor.
- With their hands, they were oriented to understand the angle that the protractor made to the right of the wand. If time permitted, they were explained the geometric concept of how this protractor made this angle.
- They were then asked to ensure that the wand and the protractor were held down firmly, and the angle was drawn using the stylus along the end of the wand and the base of the protractor.
- Whilst drawing, they were instructed that in order to draw a neat angle they could take the stylus from the top of the wand up to the vertex point, then, lift the stylus, and restart from vertex till the end of the base of the protractor.
- **APH Wand-inside Protractor:** Students were asked to bring the protractor to the free space, keep it straight, hold it down, and immobilize the protractor by putting one pin in each of the immobilization dents on either side of the protractor.

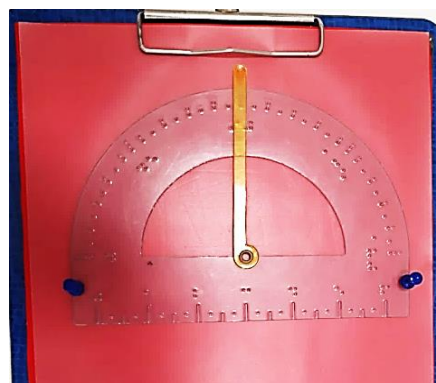


Figure 27: APH Wand-inside protractor immobilized to the sheet

- Students were asked to measure the degrees starting from the right end of the protractor, and once they had found the desired measurement, they were to align the pointed end of the wand on the appropriate tactile marking of the protractor; then, ensure the correct placement of the wand by checking the tactile markings before and after the wand.

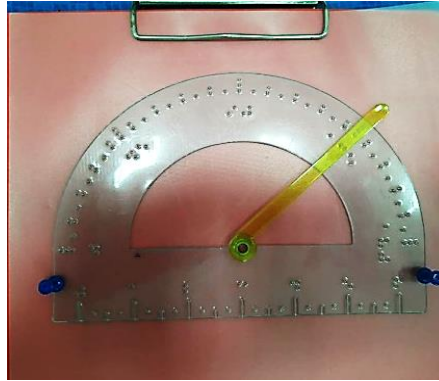


Figure 28: APH Wand-inside protractor immobilized to the sheet and set at 45 degrees

- After placing the wand on the relevant tactile marking, they were asked to immobilize it by putting a pin on the right side of the wand. Some students preferred to use two pins – one on each side of the wand.

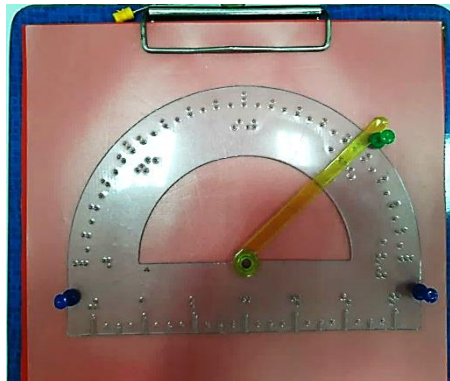


Figure 29: APH Wand-inside protractor with a pin on the right side of the wand

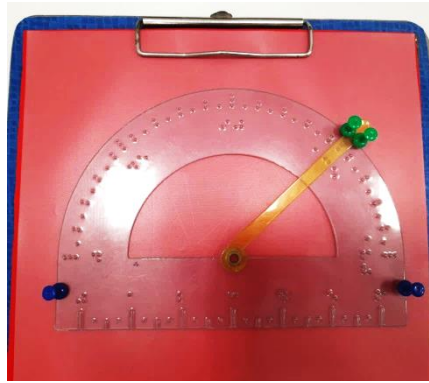


Figure 30: APH Wand-inside protractor with two pins, one on each side of the wand

- Students were asked to place three pins, one at the wand hole, one on the inside semi-circle right corner and one at the right side of the wand inside the smaller semi-circle.

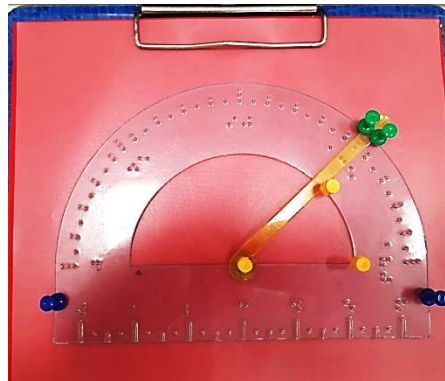


Figure 31: APH Wand-inside protractor with three more pins, marking the three points of an angle

- They were then asked to remove the protractor and the wand immobilization pins and the vertex pin at the wand hole and lift the protractor.



Figure 32: Three pins on the plastic sheet marking the three points of an angle

- They were asked to feel the vertex mark and place a pin back at the vertex. Then, they were asked to use the ruler side of the protractor

and draw a line each to join the vertex to both other pins to make the angle.

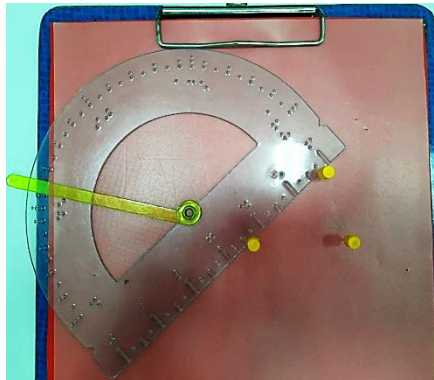


Figure 33: The ruler side of the APH Wand-inside protractor positioned to join the pins and make the angle.

- An alternate method used was that instead of lifting the protractor before drawing of lines the right side of the wand and the base of the inside semi-circle were used to draw the two arms up to the wand hole. Then the same process of lifting the protractor as per the earlier mentioned method was done and the ruler was used to extend the drawn arms up to the vertex point.
- **Garg Protractor:**
 - **Drawing of the baseline:** Students were asked to lift the Braille paper upwards, and then, place two Point Markers on the Garg board and try and keep them as straight as possible.
 - After the students had placed the point markers, they were asked to place the Braille paper back on the point markers.



Figure 34: Two Point Markers on the Garg board

- They were instructed to gently find the points through the paper and press down around both the points such that they punctured the paper.

- After the students had punctured the points, they were asked to lift the paper back.
- At this time, they were asked to place the Line Marker on the two points. After this was placed, they were asked to put the paper back on the line marker positioned on the points. They were asked to lightly feel the line marker placed underneath the paper through the sheet, beginning from the start point to the end point.



Figure 35: Two Point Markers with a Line Marker on them in the position to draw the baseline of an angle on the Garg board



Figure 36: The student lightly feeling the line marker placed underneath the paper from the top of the sheet with their hands from the start point to the end point.

- They were instructed to place the groove of the stylus on the line marker at the start point, and check for its grip at the point, hold the stylus face down on the line marker, and then drag it till the end point to draw the line segment, whilst simultaneously holding the line marker down through the paper at the start point and end point so that it does not move when the line is being drawn.
- Some students found it easier to turn the board horizontal to have a better hold and were permitted to do so.

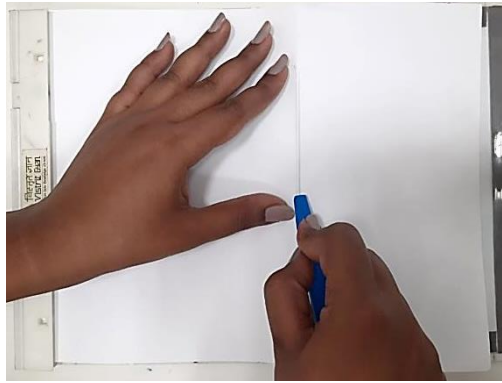


Figure 37: Drawing the baseline on the Garg board

- Finding the Vertex and Aligning to the Vertex and Baseline: After drawing the base arm, students were asked to lift the paper up again and asked to remove the line marker.
- They were now asked to place the protractor such that the centre hole of the protractor was placed on the vertex point marker and the fixed line marker on the protractor sat on the second point marker.



Figure 38: The Garg protractor positioned over the point markers

- Reading the Measurement and Plotting the Point: Students were asked to read the measurement starting at the fixed line marker and once the measurement was found, they were to place a second line marker such that it rested on the relevant tactile marking and the vertex point.



Figure 39: An extra line marker positioned from the 60-degree tactile marking on the Garg protractor towards the vertex

- Two line markers of varying lengths were used – a short one and a longer one. The longer line marker rested across the diameter of the protractor, marking on the opposite side of the 60-degree measurement as well.
- **Drawing the second arm:** Students were asked to place the paper back and gently feel the second line marker.
- They were asked to draw the second arm ensuring that it started at the vertex.

Skill 4: Measuring an Angle

For teaching the skill of measuring of an angle, the following steps were followed-

- a. Revision of the concept of an angle
 - b. Introduction to the skill of measuring angles
 - c. Orientation to TDs and the use of a protractor to measure an angle on each type of TD, as applicable
 - d. Aligning the protractor to the vertex and baseline and reading the measurement
- a. **Revision of the Concept of an Angle**
 - The concept of an angle was revised, as per the teaching methods used to explain the concept of an angle in Skill 3.
 - b. **Introduction to the Skill of Measuring Angles**
 - Students were informed that in this skill, unlike drawing in the earlier one, they would be given TDs of angles and they would have to measure the same.
 - c. **Orientation to TDs and the Use of a Protractor to Measure an Angle on each type of TD, as applicable**
 - Students were oriented to use of the Thermoform Sheet, Plastic Sheet and Braille Paper TDs with the RNIB protractor, the APH Wand protractor, and the WT Protractor, as well as the Braille Paper TD with the Garg Protractor. The method used in orienting the student to the TDs and the use of protractors for measuring an angle was as follows:
 - Handing over of the Board: Students were handed over the Exam Board
 - Handing over and Orientation to TDs: Students were explained that there were 3 types of TDs that were being used for this research- Thermoform

Sheet, Plastic Sheet and Braille Paper. They were informed about the sheet being handed over to them.

- When using the Thermoform Sheet TDs and Braille Paper TDs, students were expected to immobilize the sheet only in the Exam board clip and not at the bottom of the sheet as was done using the Exam Board Drawing Kit in Skill 3.
- For Plastic Sheet TDs, students were asked to immobilize the sheets using the Exam Board clip at the top, and also pins at the bottom, as was done in Skill 3 with the Exam Board Drawing Kit.
- On the Garg Drawing Board, they immobilized Braille paper as done in Skill 3.
- Handing over of the Protractor and Revision of the Protractor: Students were handed over the different types of protractors and were given a quick revision of the protractor design and its measurement system.

d. Aligning the Protractor to the Vertex and Baseline and Reading the Measurement

- Steps of the teaching method differed depending on the combination of the TD and protractor that was being taught and used. The change in the teaching methods to accommodate the varying protractor designs and TD formats is discussed below in detail.
- The students were handed over the Plastic sheet/Braille paper/Thermoform sheet TD.
- They were told to touch and locate the vertex and baseline.
- They were then asked to align the protractor to the vertex and baseline, the method for which differed for each protractor and is detailed below:
- **WT Protractor:** They were asked to place the 3rd tip, at the bottom-centre of the protractor, on top of the vertex point and place the 4th and 5th tips on the baseline.

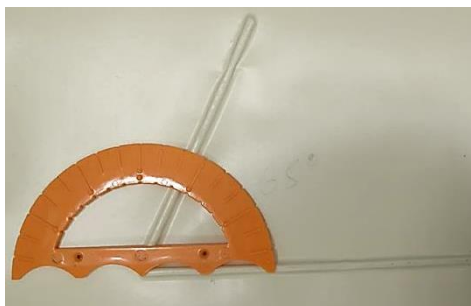


Figure 40: The WT protractor being used to measure a tactile angle on a Thermoform sheet

- Hold the protractor down in position with one hand and read the measurement with the other hand.

- On the Plastic sheet and Braille paper, where it is possible to plot pins on the sheets an alternative method could be used. The students either aligned the protractor to the vertex and baseline as mentioned above or they would place a pin at the vertex and then place the protractor.
- Also, with this protractor, some students would prefer to immobilize the protractor before measuring whilst others would prefer to hold it down with their hand.
- Once the students aligned the protractor, they were instructed to read the measurement.
- **RNIB Protractor:** Students were asked to place the RNIB pin and RNIB knob on the vertex point, and then rest the protractor on the RNIB knob and align the base of the protractor to the baseline without leaving any gaps.

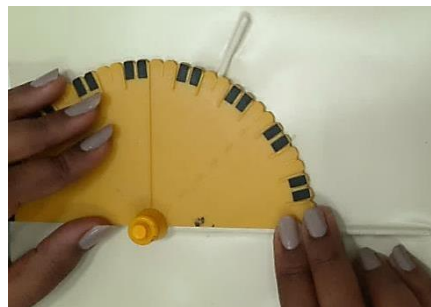


Figure 41: The RNIB protractor being used to measure a tactile angle on a Thermoform sheet

- Once the protractor was aligned, the students were instructed to hold the protractor down in position with one hand, and read the measurement with the other.
- **APH Wand Protractor**
 - Students were asked to hold the APH Wand protractor upside down, keep the wand knob loosened, and align the base of the upturned protractor to the baseline of the TD angle.

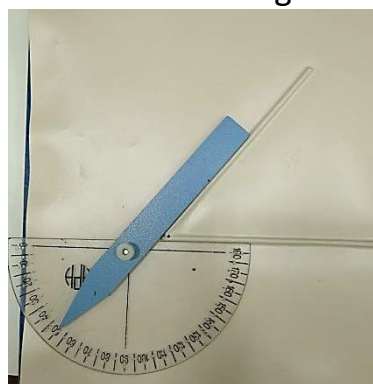


Figure 42: The APH Wand protractor being used to measure a tactile angle on a Thermoform sheet

- They were then asked to keep sliding the protractor to the left whilst retaining the alignment of the protractor to the baseline until the wand of the protractor was resting against the second arm.
- Once the protractor was held in position, with the base of the protractor against the baseline and the wand against the second arm, the students were asked to hold down the wand of the protractor and tighten the knob.
- They were then asked to turn the protractor and read the measure.
- Some students preferred to place pins on the base arm and second arm and rest the protractors against those pins whilst aligning because the lines were not clear on the plastic and braille paper sheets.
- **Garg Protractor with Braille Paper TD:** Students were handed over the paper TD.
 - They were told to touch and locate the vertex and the second arm of the angle.
 - They were then asked to place three point markers below the paper in alignment to the vertex point and a point each on the base arm and the second arm closer to the end of each arm.

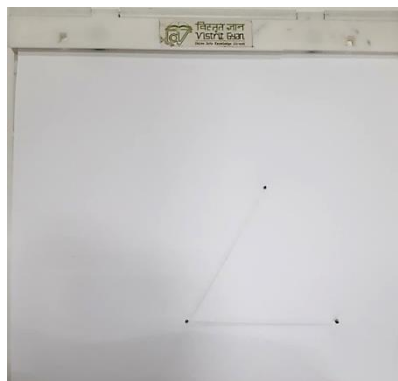


Figure 43: A tactile angle on a Braille Paper placed on the Garg Board

- They were then asked to touch the point markers through the Braille paper and once they were sure about the points, they were to puncture the holes in the paper.
- They were then asked to remove the paper and take the Garg protractor and place the central immobilization hole on the vertex point with the fixed line marker resting on the base arm point marker.



Figure 44: The Garg protractor positioned on the point markers on the Garg Board.

- They were then asked to place another line marker from the vertex point to the point marker on the second arm.



Figure 45: The Garg protractor positioned on the point markers on the Garg Board, with an extra line marker for the second arm.

- They were then asked to read the measurement starting at the fixed line marker up to the second arm line marker. In order to be sure of the measurement, they were asked to read the markings before and after the placed line marker on the second arm.



Figure 46: The Garg protractor with a line marker set at 45 degrees hiding the relevant tactile marking under it

Skill 5: Constructing a Circle

For teaching the students the skill of constructing a circle, the following steps were followed:

- a. Explaining the concept of a circle
- b. Orientation to and use of each compass to construct a circle
- c. Finding the area to draw
- d. Setting/fixing the radius and drawing the circle

a. Explaining the Concept of a Circle:

- Students were asked if they knew what a circle was, and were encouraged to draw a circle.
- Once their circle was drawn, they were shown a perfect circle drawn by the instructor. The circle had a clearly-marked centre point and students were encouraged to see both the circles.
- They were explained the concept of a circle as being a shape with a single centre point and equidistant radius from the centre point to any point on the circumference.
- They were also explained that in this skill, they were going to learn how to draw circles of different radii and that the parts of the circle that will be worked with in this skill are the centre, the radius and the circumference of the circle.

b. Orientation to and Use of each Compass to construct a Circle

- Students were oriented to use the Classmate Compass in combination with the APH Clip Ruler, the RNIB Ruler, the WT Ruler and the Squirrel Ruler; the WT ruler as a compass, the APH Compass and the Garg Compass.
- **Classmate Compass + RNIB Ruler/APH Clip Ruler/WT Ruler/Squirrel Ruler**
 - Students were given the compass in their hands, and first orientated to the sharp pin of the first leg and instructed to always be careful when using this leg.
 - They were oriented to the two legs, one with the pin and the second leg with the pen loaded on the same. They were not instructed in loading the pen as that was pre-loaded for them to save time.
 - There were told to move the legs to see how they can be pulled apart and pushed together.
 - They were also oriented to the knob at the top where the two legs joined. They were asked to loosen and tighten the knob, and

understand how the legs are immobilised when the knob is tightened.

- **WT Ruler as a Compass**

- Students were given the WT ruler in their hand and instructed that this time we would be using this ruler as a compass.
- In order for the ruler to be used as a compass, they were told that they semi-circle end of the ruler and the hole therein would be used as the first leg, and the holes down the middle of the ruler corresponding to the tactile markings would be used to insert the stylus which would be used as the second leg.

- **APH Compass**

- Students were given the compass in their hands and first orientated to the sharp tip of the fixed leg and instructed to always be careful about the same.
- They were oriented to the two legs, one with the point tip and the other with the spur wheel.
- They were told to move the legs to see how the pointed tip leg was fixed whereas the leg with the spur wheel could slide along the horizontal bar of the compass.
- They were also then oriented to the screw at the stop of the spur wheel leg. They were asked to loosen and tighten the screw, and understand how the legs are immobilised when the knob is tightened.
- They were also oriented to the measurement markings on the two sides of the horizontal bar of the compass. Both the sides had long marks and short marks, but the marks on one of the sides were more spread out, indicating it was the inches side and the other side was the cm side. For the purpose of the research, the cm side was used.

- **Garg Compass**



Figure 47: Circle markers of different sizes from the Garg Geometry Kit

- Students were given the circle markers to feel.
- They were asked to explore that each circle marker was of different size and had a braille reading of the measurement of the marker.
- They were also oriented to the central immobilisation hole on the circle marker

c. Finding the Area to Draw

- **Classmate Compass , WT Ruler as Compass, APH Compass**

- Students were asked to explore their immobilized sheet and find free space to draw on.
- They were asked to locate the centre of the page. Help was given to those who struggled at this stage.

- **Garg Compass**

- Students were asked to find free space on top of the paper and the centre point on top of the paper.
- After this students were asked to lift the paper and bend it slightly near the clip so that it would not fall back and asked for corresponding free space on the board.



Figure 48: A point marker placed at the centre of the Garg board

d. Setting/fixing the Radius & Drawing the Circle

- **Classmate Compass + RNIB Ruler/ APH Clip Ruler/ Worth Trust Ruler/Squirrel Rulers**

- Students were asked to rest the ruler on the immobilization pins on the bottom of the sheet. Specifically for the RNIB ruler with the groove side up and with the cm side up for the APH clip ruler.
- The method of adjusting and resting the compass legs against the ruler markings for each ruler is detailed below:



Figure 49: The Classmate compass being aligned for a specific measurement with the RNIB ruler on the Exam board

- **For the RNIB ruler:** They were instructed to take the pin leg of the compass and place it in the groove of any extra-long mark/ other mark. They were also instructed to always press down the leg completely into the mat. They had to read on the ruler, the measurement given to them, and place the pen leg of the compass at the groove of the desired mark.
- **For the APH Clip ruler:** They were instructed to take the pin leg of the compass and place it on any long mark/ other mark of the ruler. They were also instructed to always press down the leg completely into the mat. They had to read on the ruler, the measurement given to them, and place the pen leg of the compass at that mark.



Figure 50: The Classmate compass being aligned for a specific measurement with the APH clip ruler on the Exam board

- **For the WT ruler:** They were instructed to take the pin leg of the compass and place it in the centre hole next to on any long mark/ other mark. They were also instructed to always press down the leg completely into the mat. They were then instructed to read on the ruler, the measurement given to them, and place the pen leg of the compass at the centre hole of that mark.



Figure 51: The Classmate compass being aligned for a specific measurement with the WT ruler on the Exam board

- **For the Squirrel ruler:** They were instructed to set the measurement on the ruler. Once the measurement was set, they were instructed to place the two legs of the compass at the two clip edges of the ruler, whilst holding down the ruler and ensuring that the clip did not move. They were also instructed to keep the first leg pressed fully down into the mat.



Figure 52: The Classmate compass being aligned for a specific measurement with the Squirrel ruler on the Exam board

- They were instructed to do the above whilst holding down the ruler and the first leg.



Figure 53: The Classmate compass being aligned for a specific measurement with the Squirrel ruler on the Exam board

- After they had finished placing the compass to the right measurement, they were asked to tighten the knob by being careful to not press the legs together whilst tightening the knob.
- For students who struggled in pulling out the compass to the right measurement with one hand, they were instructed to first keep the compass fully stretched, and after fixing the first leg to the start point, push back the compass to the right measurement mark.
- Students were asked to bring the pin leg of the compass to the centre, and press it down completely into the mat. They were instructed to ensure that they were holding the compass lightly and were not pushing/moving the legs of the compass.
- After they had pressed down the first leg, they were asked to hold the other leg of the compass from the side and not on top of the leg as the latter could lead to the leg getting pushed back towards the pin leg.
- They were then instructed to turn the mat whilst holding down the second leg of the compass on the sheet such that the pen would make the drawing on the sheet.
- As they drew, they were asked to check the sheet for the mark being drawn, and to stop when the circle was complete.
- **WT Ruler as a Compass**
 - Students were asked to place the ruler's semi-circle end at the centre of the page and immobilize the ruler by placing a pin through its hole.
 - They were then instructed to move the ruler 360 degrees, and in case the ruler clashed with either the exam board clip or the immobilization pins placed below, they were asked to remove the clip/immobilization pins.
 - They were asked to measure the radius, and place the stylus in the hole corresponding to the measurement, and draw the circle by moving the stylus along with the ruler around to make the circle.



Figure 54: The WT ruler being used as a compass to draw a circle

- They could either turn the board whilst doing this or turn the ruler whilst keeping the board straight.

- Having the centre immobilised was helpful to ensure a fixed single centre.
- **APH Compass**

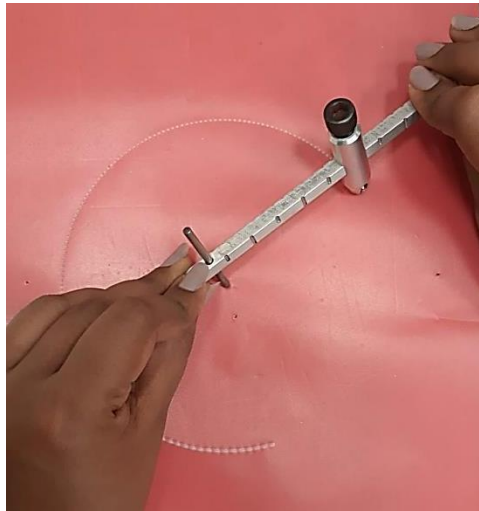


Figure 55: A circle being drawing with the APH compass

- Students were asked to fix the measurement on the compass by counting on the cm side and by bringing the spur wheel leg to the precise measurement mark. They were instructed to count the first long mark as 1. In order to do the same accurately, they were asked to keep their fingers in the dent of the final tactile mark and to bring the spur wheel leg just next to the finger.
- They were then asked to tighten the screw to immobilise the second arm.
- They were asked to bring the pointed leg of the compass to the centre and press it down completely, and keep one hand holding it down all the time.
- They were asked to hold the second leg of the compass and turn the compass whilst holding down the second leg of the compass on the sheet.
- As they turned the compass, they were also instructed to exchange their hands holding the first leg and the second leg to make drawing easy as the compass turned 360 degrees.
- Since this compass had a spur wheel the drawing happened on the reverse side.

- **Garg Compass**



Figure 56: A circle being drawing with the Garg compass/Circle marker

- Students were asked to place a point marker at the centre point on the board, corresponding to the centre point found on the paper.
- They were asked to press the paper down and puncture the hole and lift the paper back up.
- They were asked to identify a Circle Marker of the desired radius, and instructed to place it on the Point marker completely flat while ensuring that the point marker had not moved.
- They were then asked to place the paper back on the Point marker and Circle marker whilst being careful that the Point marker and Circle marker did not move under the paper.
- They were asked to gently press the paper down with their hands along the outer edge of the Circle marker.
- Then, using the Garg stylus, they were asked to draw over the Circle marker. Those who preferred to turn the board whilst drawing were allowed to do so.

Skill 6: Constructing/Cutting Arcs

For teaching them concept of arcs, the following steps were followed:

- Explaining the concept of arcs in link with line bisection as an example
- Orientation to and use of each compass to cut arcs for line bisection
- Orientation to line segments and measurement**
- Fixing the compass legs to the end points of line segments and setting the radius
- Drawing the arc
- Finding the intersecting points and drawing the bisector

a. Explaining the concept of Arcs in link with Line Bisection as an example

- Students were given an explanation of what an arc is with line bisection as an example.
- Students were explained what an arc is. They were told that an arc is a part of the circumference of a circle, and like a circle, an arc would have a fixed point of drawing.
- They were explained that arcs are used for various functions in geometry, and in this skill, we would learn how to use the different compasses for drawing arcs for a line bisector.
- They were explained that line bisection means cutting the line segment into two equal halves.

b. Orientation to and Use of each Compass to Cut Arcs for Line Bisection

- Since the students were already oriented to the compasses in Skill 5, the same was not repeated here.
- Since the Garg Arc Markers were new, the students were oriented to them. Some students in the research used the circle markers instead.

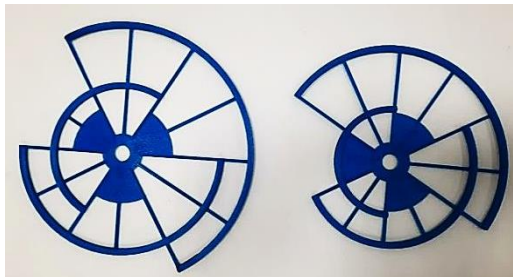


Figure 57: Arc markers of different sizes from the Garg Geometry Kit

- Students were asked to move their hands over the arc marker and find the number of arcs, the centre hole and the braille readings on the same.
- They were explained to use the braille signs and to locate the arc corresponding to that measurement.

c. Orientation to Line Segments and Measurement

- For the purpose of research in order to save time, they were not asked to draw the line segment. They were given a sheet with a pre-drawn line segment and informed of its length.
- They were also informed that in order to draw a line bisector they must set the radius of the compass to more than half but less than the full the length of the segment.

d. Fixing the Compass Legs to the End Points of Line Segments and Setting the Radius**• Classmate Compass**

- Students were asked to loosen the compass knob and bring the pin leg of the compass to either of the end points of the line segment, and press it down completely.
- They were then asked to set the radius by judging the line length and placing the pen leg of the compass up to more than half but less than the full length of the line segment. Once they had set the radius, they were asked to tighten the compass knob and fix the compass legs to position.



Figure 58: The radius of the Classmate compass being set

• APH Compass

- Students were asked to fix the measurement on the APH compass by counting on the cm side and bringing the spur wheel leg to the mark at which the measurement completes more than half but less than the full length of the line segment, or take a guess along the line segment by placing the first leg down at the end point and adjusting the second leg along the line segment.

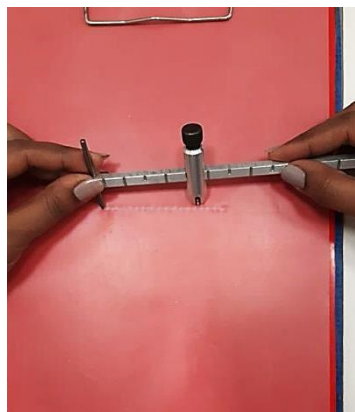


Figure 59: The radius of the APH compass being set

- If they were using the pre-counted measurement method, they were instructed to count the first long mark as 1. In order to do the same accurately, they were asked to keep their fingers in the dent of the final tactile mark, and to bring the spur wheel leg just next to the finger.
- They were then asked to tighten the screw to immobilise the second leg at the desired measure.

e. Drawing the Arc

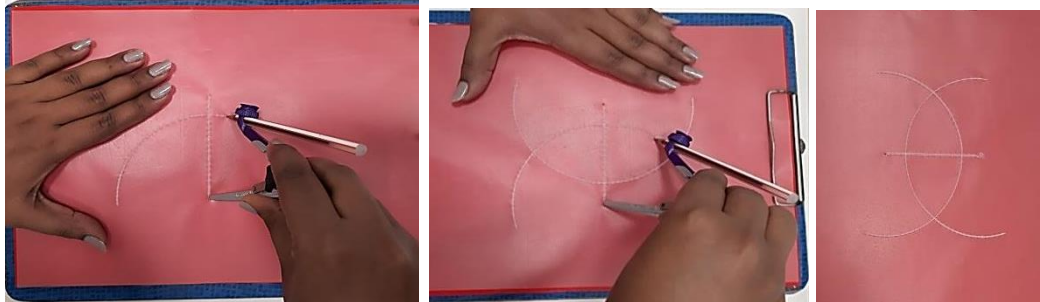


Figure 60: Cutting arcs

- Students were asked to bring the point leg of the compass to either of the end points and press it down completely, and keep one hand holding it down all the time.
- They were asked to hold the second leg of the compass, and turn the compass whilst holding down the second leg of the compass on the sheet.
- They were asked to make an extended arc on the side of the line segment such that the arc is a semi-circle passing through the line segment.
- They were asked to repeat this from the other end of the line segment as well.
- Since the APH compass had a spur wheel the drawing happened on the reverse side.

f. Finding the intersecting points and drawing the bisector

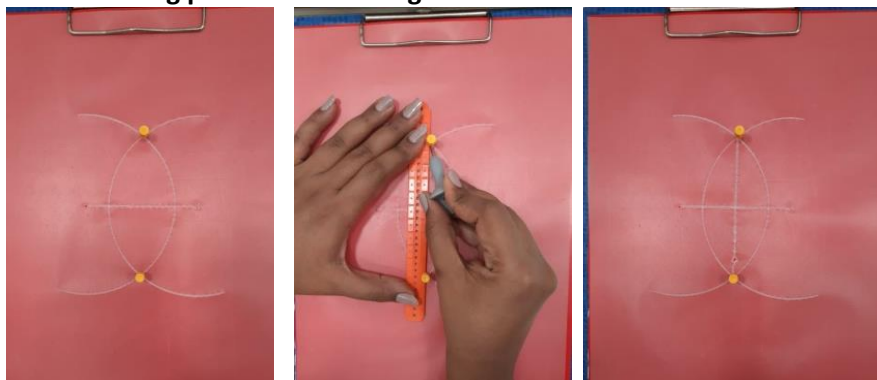


Figure 61: Line bisection on the Exam board

- Students were asked feel the entire drawing and identify the line segment, the area above and below it, the parts at which the arcs cut the line segment and the points of intersection of the arcs above and below the line segment.
- Students were asked to place a pin at the intersection points of the arcs both above and below the line segment.
- They were then asked to place the ruler resting against the two pins at the intersection points and join the points with a stylus whilst holding down the ruler.
- They were then asked to measure and see the line segment on either sides of the line bisector to check whether it was accurately bisected.

- Since the WT ruler as a compass and the Garg compass used a different system steps d, e, and f happened for them in a slightly different variation which are listed below.

- **WT Ruler as a Compass: Fixing the Compass Legs to the end points of line segments + Setting the Radius + Drawing the Arc**
 - Students were asked to place a pin in the ruler's semi-circle end, and bring the same to either of the end points, locate the exact point and immobilize the ruler by pressing down the pin.
 - They were then instructed to take a measurement on the ruler for the radius based on the length of the line segment (more than half but less than the full length of the line segment), and keep in mind the measurement.
 - They were asked to place a stylus at the hole of the selected measurement, and they were asked to make a full arc on the side of the line segment such that the arc is a proper semi-circle passing through the line segment.
 - They were asked to repeat this from the other end of the line segment as well.

- **Garg Compass: Fixing Compass Leg to end points of line segment + Setting the Radius + Drawing the Arc :**



Figure 62: Line bisection with the Garg kit

- Students were asked to place two point markers on the board corresponding to the end points found on the paper.
 - They were asked to press the paper down and puncture the holes and lift the paper back.
 - They were asked to identify and place the arc marker/circle marker of the desired radius and place it on the point marker fully flat ensuring that the point marker did not move.
 - They were asked to select the arc marker/circle marker based on either selecting the marker of a measurement more than half but less than the full length of the line segment, or they were asked to put the arc markers/circle marker on one of the end points and make a judgement in reference to the second point marker.
 - They were asked to then place the paper back on the arc/circle markers whilst being careful that the point marker and arc/circle markers did not move under the paper.
 - They were asked to gently press down the paper along the outer edge of the circle marker or the desired arc circumference of the arc marker.
 - Using the stylus, they were asked to draw over the same using the Garg stylus. Those who preferred turned the board whilst drawing.
- **Garg Compass: Finding the intersecting points and drawings the bisector**

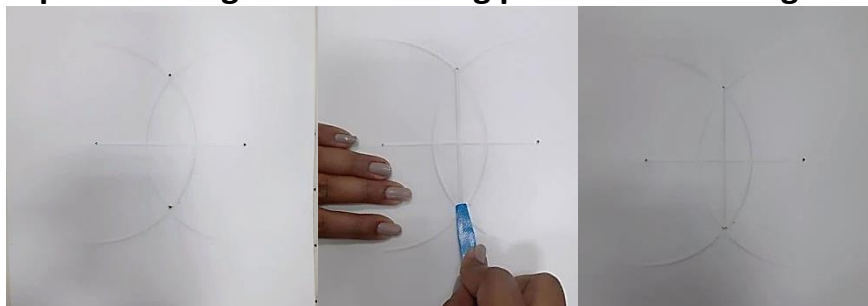


Figure 63: Line bisection with the Garg kit

- Students were asked feel the entire drawing and identify the line segment, the area above and below it, the parts that the arcs cut the line

segments and points of intersection of the arcs above and below the line segment.

- Students were asked to place a point marker under the Braille paper corresponding to the intersection points of the arcs both above and below the line segment.
- They were then asked to place the paper down, and puncture holes at the point makers.
- They were asked to lift the paper, and place a line marker over the two point markers, place the paper back down, and draw over the line marker connecting the two points.

ANNEXURE H: DATA TABLES FOR CHAPTER 3
Table 3.1 Skill 1: Key Issues: Training Phase (%)

Skill 1: Training Key Issues	APH Clip Ruler	Draftsman Ruler	Garg Ruler	RNIB Ruler	Squirrel Ruler	Worth Trust Ruler	
Points/point markers/clip not accurately plotted against the marks	10	62.5	15	42.5	0	42.5	28.75
Ruler movement or going crooked at Measuring and Plotting End point	20	0	37.5	35	12.5	20	20.83 333
struggled in pushing pins in the board/struggled in sliding point markers to position	0	20	65	5	0	2.5	15.41 667
Ruler Movement at plotting start point	15	0	30	27.5	5	15	15.41 667
Drawing before end point	27.5	10	7.5	22.5	2.5	17.5	14.58 333
Drawing beyond end point	5	17.5	25	12.5	0	17.5	12.91 667
Stylus going away from the ruler whilst drawing	5	12.5	0	12.5	10	30	11.66 667
Using wrong side of the ruler	0	35	2.5	30	0	0	11.25
Board Turned to Draw	10	7.5	5	10	22.5	7.5	10.41 667
Struggled Drawing on the sheet	15	10	5	10	2.5	15	9.583 333
Difficulty in straightening the ruler at the start	12.5	2.5	12.5	10	10	10	9.583 333
Ruler Movement in Centralising the Ruler	17.5	5	7.5	5	7.5	5	7.916 667

Struggled with 0.5 Measurements	0	25	2.5	10	7.5	2.5	7.916 667
Drawing after start point	22.5	2.5	7.5	2.5	2.5	7.5	7.5
Students Counting the start point mark as 1 instead of 0	0	7.5	5	10	2.5	15	6.666 667

Table 3.1.1 Skill 1: Training Phase: Older (O)-Younger (Y) Variation (%)

		APH Clip Ruler	Draftsman Ruler	Garg Ruler	RNIB Ruler	Squirrel Ruler	Worth Trust Ruler	
Difficulty in straightening the ruler at the start	O	5	5	5	10	5	0	5
	Y	20	0	20	10	15	20	14.16 667
Ruler Movement in Centralising the Ruler	O	10	5	0	0	5	5	4.166 667
	Y	25	5	15	10	10	5	11.66 667
Ruler Movement at plotting start point	O	20	0	30	35	5	25	19.16 667
	Y	10	0	30	20	5	5	11.66 667
Struggled with 0.5 Measurements	O	0	20	0	0	5	5	5
	Y	0	30	5	20	10	0	10.83 333
Ruler movement or going crooked at Measuring and Plotting End point	O	20	0	45	45	15	30	25.83 333
	Y	20	0	30	25	10	10	15.83 333
Drawing after start point	O	5	0	0	5	0	0	1.666 667
	Y	40	5	15	0	5	15	13.33 333

Table 2.2 Skill 1: Key Issues: Test Phase (%)

	APH Clip Ruler	Draftsma n Ruler	Garg Ruler	RNIB Ruler	Squirrel Ruler	Worth Trust Ruler	Total
Points/point markers/clip not accurately plotted against the marks	15	50	25	47.5	7.5	22.5	27.9 1667
Drawing before end point	27.5	27.5	7.5	30	12.5	22.5	21.2 5
Ruler movement at connecting two points	50	2.5	5	15	30	17.5	20
Ruler movement or going crooked at Measuring and Plotting End point	15	2.5	30	27.5	12.5	10	16.2 5
Careless counting mistakes/Measuring mistake	12.5	25	7.5	12.5	10	12.5	13.3 3333
Struggled Drawing on the sheet	5	12.5	22.5	12.5	7.5	12.5	12.0 8333
Drawing beyond end point	5	10	17.5	10	10	17.5	11.6 6667
Using wrong side of the ruler	5	17.5	2.5	42.5	0	0	11.2 5
Ruler Movement in Centralising the Ruler	17.5	0	10	7.5	20	2.5	9.58 3333
Ruler Movement at plotting start point	5	0	17.5	10	12.5	10	9.16 6667
Struggled in pushing pins in the board/Struggled in	0	0	52.5	0	0	0	8.75

sliding point markers to position							
Drawing after start point	20	5	2.5	2.5	7.5	15	8.75
Struggled in Immobilizing the ruler itself	0	25	0	0	0	17.5	7.08 3333
Struggled in Immobilizing the paper	2.5	25	10	0	2.5	0	6.66 6667
Clip movement at drawings	15	0	0	0	22.5	0	6.25
Board Turned to Draw	5	7.5	5	5	2.5	10	5.83 3333
Stylus going away from the ruler whilst drawing	7.5	7.5	0	10	5	5	5.83 3333
Difficulty using Garg Stylus	0	0	30	0	0	0	5
Difficulty Understanding markings on the ruler	7.5	7.5	0	10	0	2.5	4.58 3333
Difficulty in straightening the ruler at the start	10	2.5	0	2.5	10	2.5	4.58 3333
Clip movement at end point plotting	20	0	0	0	7.5	0	4.58 3333
Struggled in aligning the sheet to the mat	0	7.5	5	7.5	2.5	0	3.75
Alignment of end point with inner edge of clip rather than jut out leading to measurement errors	17.5	0	0	0	0	0	2.91 6667
Difficulty in understanding the 16 divided concept for inches	0	0	0	0	17.5	0	2.91 6667

Line marker moved whilst drawing	0	0	17.5	0	0	0	2.91 6667
Gap between pin and ruler whilst drawing causing errors	0	5	0	10	0	0	2.5
Struggled in sliding the sheet and the mat in the board	2.5	0	0	10	0	0	2.08 3333
Struggled in finding Free Space to draw	0	0	10	0	0	0	1.66 6667
Line creasing due to holding down line marker causing extend lines and confusion	0	0	7.5	0	0	0	1.25

Table 3.2.1.Skill 1: Test Phase: Older (O)-Younger (Y) Variation (%)

		APH Clip Ruler	Draftsm an Ruler	Gar g Rule r	RNIB Ruler	Squirre l Ruler	Worth Trust Ruler	Total
Struggled in Immobilizing the paper	Older	0	15	10	0	0	0	4.16666667
	Young er	5	35	10	0	5	0	9.16666667
Ruler Movement in Centralising the Ruler	Older	5	0	0	5	20	0	5
	Young er	30	0	20	10	20	5	14.16666667
Clip movement at end point plotting	Older	15	0	0	0	0	0	2.5
	Young er	25	0	0	0	15	0	6.66666667

Table 3.3: Skill 2: Key Issues: Training Phase (%)

	Row Label	APH Clip Ruler	Gar g Rule r	RNIB Ruler	Squirrel Ruler	Worth Trust Ruler	Total
Errors in placing end point pins on marked TDs	Paper Total	12.5	55	15	6.66666 7	8.33333 3	36.5
	Plastic Sheet Total	14.1666 7	0	18.3333 3	13.3333 3	15.8333 3	46.25
	Thermoform Total	1.66666 7	0	0	0.83333 3	0.83333 3	2.5
	Grand Total	28.3333 3	55	33.3333 3	20.8333 3	25	29.0384 6
Points/point markers/clip not accurately plotted against the marks	Paper Total	8.33333 3	22.5	6.66666 7	2.5	3.33333 3	17
	Plastic Sheet Total	5	0	5.83333 3	5.83333 3	4.16666 7	15.625
	Thermoform Total	4.16666 7	0	3.33333 3	3.33333 3	3.33333 3	10.625
	Grand Total	17.5	22.5	15.8333 3	11.6666 7	10.8333 3	14.6153 8
Careless counting mistakes/Measuring mistake	Paper Total	4.16666 7	7.5	1.66666 7	0.83333 3	1.66666 7	6.5

	Plastic Sheet Total	1.666667	0	3.333333	0.833333	2.5	6.25
	Thermoform Total	7.5	0	9.166667	0.833333	5.833333	17.5
	Grand Total	13.333333	7.5	14.166667	2.5	10	9.807692
Ruler Movement at start point (plotting or during measurement)	Paper Total	5	7.5	0	0	3.333333	6.5
	Plastic Sheet Total	3.333333	0	2.5	1.666667	1.666667	6.875
	Thermoform Total	8.333333	0	4.166667	0.833333	8.333333	16.25
	Grand Total	16.666667	7.5	6.666667	2.5	13.333333	9.615385
Gap between Ruler and line	Paper Total	1.666667	0	0	1.666667	1.666667	3
	Plastic Sheet Total	5	0	0	1.666667	0.833333	5.625
	Thermoform Total	5	0	5	5.833333	0.833333	12.5
	Grand Total	11.666667	0	5	9.166667	3.333333	6.730769
Braille Reading Skill Limitations	Paper	0	0	0	5	0	3

	Total						
	Plastic Sheet Total	0	0	0	12.5	0	9.375
	Thermoform Total	0	0	0	9.166667	0	6.875
	Grand Total	0	0	0	26.66667	0	6.153846
Struggled in pushing pins in the board/Struggled in sliding point markers to position	Paper Total	0	57.5	0	0	0	11.5
	Plastic Sheet Total	0	0	0	0	0	0
	Thermoform Total	0	0	0	0	0	0
	Grand Total	0	57.5	0	0	0	4.423077
Pin/clip little off and guessing measure	Paper Total	0.833333	2.5	2.5	5	3.333333	7.5
	Plastic Sheet Total	0	0	1.666667	2.5	0.833333	3.75
	Thermoform Total	0	0	0	0.833333	0	0.625
	Grand Total	0.833333	2.5	4.166667	8.333333	4.166667	4.230769

Ruler movement or going crooked at Measuring and Plotting End point	Paper Total	2.5	7.5	1.666667	0.833333	0.833333	5
	Plastic Sheet Total	2.5	0	1.666667	0	0.833333	3.75
	Thermoform Total	1.666667	0	1.666667	0.833333	0	3.125
	Grand Total	6.666667	7.5	5	1.666667	1.666667	4.038462
Using wrong side of the ruler	Paper Total	1.666667	0	2.5	0	0	2.5
	Plastic Sheet Total	4.166667	0	1.666667	0	0	4.375
	Thermoform Total	2.5	0	4.166667	0	0	5
	Grand Total	8.333333	0	8.333333	0	0	3.846154
Students Counting the start point mark as 1 instead of 0	Paper Total	1.666667	0	0	0	0.833333	1.5
	Plastic Sheet Total	2.5	0	2.5	0	3.333333	6.25
	Thermoform Total	0.833333	0	1.666667	0	3.333333	4.375
	Grand	5	0	4.166667	0	7.5	3.84615

	Total			7			4
Struggled with 0.5 Measurements	Paper Total	0	0	1.666667	1.666667	0	2
	Plastic Sheet Total	0.833333	0	0.833333	4.166667	0	4.375
	Thermoform Total	0	0	0	6.666667	0	5
	Grand Total	0.833333	0	2.5	12.5	0	3.653846
TDs not distinct enough	Paper Total	0.833333	10	0.833333	0	1.666667	4
	Plastic Sheet Total	0	0	0.833333	1.666667	0.833333	2.5
	Thermoform Total	0.833333	0	0	0.833333	1.666667	2.5
	Grand Total	1.666667	10	1.666667	2.5	4.166667	3.076923
Student putting the start point at 0.5 mark leading to measurement errors later	Paper Total	0.833333	2.5	0	0	1.666667	2
	Plastic Sheet Total	0.833333	0	1.666667	0	0	1.875
	Thermoform Total	0.833333	0	5	0	0	4.375

	Grand Total	2.5	2.5	6.666667	0	1.666667	2.692308
Difficult in replotting the correct end points once pin mark was made in an inaccurate spot	Paper Total	0.833333	10	0	0.833333	2.5	4.5
	Plastic Sheet Total	1.666667	0	0	0	1.666667	2.5
	Thermoform Total	0	0	0	0	0	0
	Grand Total	2.5	10	0	0.833333	4.166667	2.5
Difficulty in understanding the 16 divided concept for inches	Paper Total	0	0	0	2.5	0	1.5
	Plastic Sheet Total	0	0	0	3.333333	0	2.5
	Thermoform Total	0	0	0	4.166667	0	3.125
	Grand Total	0	0	0	10	0	2.307692
Difficulty Understanding markings on the ruler	Paper Total	0	2.5	1.666667	0	0.833333	2
	Plastic Sheet Total	0	0	1.666667	0	0.833333	1.875
	Thermoform	0.833333	0	0	0	1.666666	1.875

	m Total	3				7	
	Grand Total	0.83333 3	2.5	3.33333 3	0	3.33333 3	1.92307 7
Clip movement at end point plotting/measuring	Paper Total	0.83333 3	0	0	0.83333 3	0	1
	Plastic Sheet Total	0	0	0	0.83333 3	0	0.625
	Thermoform Total	0.83333 3	0	0	4.16666 7	0	3.75
	Grand Total	1.66666 7	0	0	5.83333 3	0	1.73076 9
Board Turned to Draw	Paper Total	0	0	0	0	0	0
	Plastic Sheet Total	0.83333 3	0	0.83333 3	0	0.83333 3	1.875
	Thermoform Total	0.83333 3	0	0.83333 3	0.83333 3	0	1.875
	Grand Total	1.66666 7	0	1.66666 7	0.83333 3	0.83333 3	1.15384 6
Struggled in aligning the sheet to the mat	Paper Total	0.83333 3	0	0	0	0	0.5
	Plastic Sheet Total	0.83333 3	0	0	1.66666 7	0	1.875

	Thermoform Total	0.833333	0	0	0	0	0.625
	Grand Total	2.5	0	0	1.666667	0	0.961538

Table 3.3.1 Skill 2: Training Phase: Older (O)-Younger (Y) Variation (%)

	0		APH Clip Ruler	Garg Ruler	RNIB Ruler	Squirrel Ruler	Worth Trust Ruler	
Using wrong side of the ruler	Plastic Sheet	O	0	0	5	0	0	1.2 5
	0	Y	25	0	5	0	0	7.5
Ruler Movement at start point (plotting or during measurement)	Plastic Sheet	O	5	0	5	0	0	2.5
	0	Y	15	0	10	10	10	11. 25
Careless counting mistakes/Measuring mistake	Plastic Sheet	O	5	0	20	5	0	7.5
	0	Y	5	0	0	0	15	5
Errors in placing end point pins on marked TDs	Plastic Sheet	O	35	0	45	50	40	42. 5
	0	Y	50	0	65	30	55	50
Gap between Ruler and line	Thermof orm	O	10	0	10	10	5	8.7 5
	0	Y	20	0	20	25	0	16. 25
Using wrong side of the ruler	Thermof orm	O	10	0	20	0	0	7.5
	0	Y	5	0	5	0	0	2.5
Careless counting mistakes/Measuring mistake	Thermof orm	O	20	0	20	5	15	15
	0	Y	25	0	35	0	20	20

Ruler Movement at start point (plotting or during measurement)	Thermof orm	O	20	0	10	0	15	11. 25
	0	Y	30	0	15	5	35	21. 25
Careless counting mistakes/Measuring mistake	Paper	O	20	10	5	5	5	9
	0	Y	5	5	5	0	5	4
Errors in placing end point pins on marked TDs	Paper	O	25	50	35	25	20	31
	0	Y	50	60	55	15	30	42
Ruler Movement at start point (plotting or during measurement)	Paper	O	5	0	0	0	10	3
	0	Y	25	15	0	0	10	10

Table 3.4: Skill 2: Key Issues: Test Phase (%)

		APH	Garg Rule r	RNIB Ruler	Squirrel Ruler	Worth Trust Ruler	Total
Errors in placing end point pins on marked TDs	Paper Total	9.16666 7	55	13.3333 3	10	15	39.5
	Plastic Sheet Total	15.8333 3	0	17.5	14.1666 7	10	43.125
	Thermoform Total	0.83333 3	0	1.66666 7	1.66666 7	2.5	5
	Grand Total	25.8333 3	55	32.5	25.8333 3	27.5	30
Points/point markers/clip not accurately plotted against the marks	Paper Total	4.16666 7	17.5	5.83333 3	7.5	4.16666 7	16.5
	Plastic Sheet Total	7.5	0	10	4.16666 7	3.33333 3	18.75
	Thermoform Total	7.5	0	2.5	2.5	3.33333 3	11.875
	Grand Total	19.1666 7	17.5	18.3333 3	14.1666 7	10.8333 3	15.7692 3
Careless counting mistakes/Measuring mistake	Paper Total	5.83333 3	7.5	3.33333 3	2.5	2.5	10
	Plastic Sheet Total	4.16666 7	0	5	0.83333 3	3.33333 3	10
	Thermoform Total	5	0	3.33333 3	1.66666 7	3.33333 3	10

	Grand Total	15	7.5	11.6666 7	5	9.16666 7	10
Student putting the start point at 0.5 mark leading to measurement errors later	Paper Total	5.83333 3	5	2.5	0	3.33333 3	8
	Plastic Sheet Total	4.16666 7	0	3.33333 3	0	3.33333 3	8.125
	Thermoform Total	4.16666 7	0	1.66666 7	0	2.5	6.25
	Grand Total	14.1666 7	5	7.5	0	9.16666 7	7.5
Ruler Movement at start point (plotting or during measurement)	Paper Total	3.33333 3	7.5	0	0.83333 3	1.66666 7	5
	Plastic Sheet Total	5	0	0.83333 3	0	1.66666 7	5.625
	Thermoform Total	6.66666 7	0	2.5	2.5	3.33333 3	11.25
	Grand Total	15	7.5	3.33333 3	3.33333 3	6.66666 7	7.11538 5
Using wrong side of the ruler	Paper Total	2.5	0	2.5	0	0.83333 3	3.5
	Plastic Sheet Total	1.66666 7	0	2.5	0	0	3.125
	Thermoform Total	5	0	10.8333 3	0	0	11.875
	Grand Total	9.16666 7	0	15.8333 3	0	0.83333 3	5.96153 8

Pin/clip little off and guessing measure	Paper Total	0	5	1.666667	0.833333	1.666667	3.5
	Plastic Sheet Total	3.333333	0	4.166667	3.333333	1.666667	9.375
	Thermoform Total	1.666667	0	0	0	1.666667	2.5
	Grand Total	5	5	5.833333	4.166667	5	5
Ruler movement or going crooked at Measuring and Plotting End point	Paper Total	1.666667	5	0.833333	0	3.333333	4.5
	Plastic Sheet Total	3.333333	0	0	0	1.666667	3.75
	Thermoform Total	0.833333	0	0.833333	0.833333	1.666667	3.125
	Grand Total	5.833333	5	1.666667	0.833333	6.666667	3.846154
Braille Reading Skill Limitations	Paper Total	0	0	0	4.166667	0	2.5
	Plastic Sheet Total	0	0	0	5	0	3.75
	Thermoform Total	0	0	0	6.666667	0	5
	Grand Total	0	0	0	15.833333	0	3.653846
Gap between Ruler and line	Paper Total	1.666667	0	0.833333	0.833333	1.666667	3
	Plastic Sheet Total	0.833333	0	2.5	2.5	0	4.375

		3					
	Thermoform Total	0	0	0	2.5	0.83333 3	2.5
	Grand Total	2.5	0	3.33333 3	5.83333 3	2.5	3.26923 1
Struggled in pushing pins in the board/struggled in sliding point markers to position	Paper Total	0	32.5	0	0	0.83333 3	7
	Plastic Sheet Total	0	0	0	0	0	0
	Thermoform Total	0	0	0	0	0	0
	Grand Total	0	32.5	0	0	0.83333 3	2.69230 8
Difficulty Understanding markings on the ruler	Paper Total	0	0	1.66666 7	0	0.83333 3	1.5
	Plastic Sheet Total	1.66666 7	0	1.66666 7	0	1.66666 7	3.75
	Thermoform Total	0	0	1.66666 7	0	0.83333 3	1.875
	Grand Total	1.66666 7	0	5	0	3.33333 3	2.30769 2
Clip movement at end point plotting/measuring	Paper Total	1.66666 7	0	0	0.83333 3	0	1.5
	Plastic Sheet Total	0	0	0	1.66666 7	0	1.25
	Thermoform Total	2.5	0	0	0.83333 3	0	2.5
	Grand Total	4.16666	0	0	3.33333	0	1.73076

		7			3		9
Difficult in replotting the correct end points once pin mark was made in an inaccurate spot	Paper Total	0	12.5	0	0	0	2.5
	Plastic Sheet Total	0	0	0.83333 3	0	0	0.625
	Thermoform Total	0	0	0	0	0	0
	Grand Total	0	12.5	0.83333 3	0	0	1.15384 6

ANNEXURE I: DATA TABLES FOR CHAPTER 4
Table 4.1: Skill 3: Key Issues: Training Phase (%)

		APH Wand- inside Protracto r Total	APH Wand Protracto r Total	Garg Protracto r Total	RNIB Protracto r Total	WT Protracto r Total	Grand Total
Difficulty in straightening the ruler/protractor/point markers for baseline drawing	APH Clip Ruler	0	0	0	5.309735	6.837607	18.66667
	None	20.51282	37.5	15	0	0	24.36975
	RNIB Ruler	0	0	0	3.539823	1.709402	7.594937
	WT Ruler	0	0	0	13.27434	11.96581	38.15789
	Total	20.51282	37.5	15	22.12389	20.51282	22.34957
Struggled in aligning protractor to vertex and Baseline	APH Clip Ruler	0	0	0	6.19469	8.547009	22.66667
	None	2.564103	2.5	5	0	0	3.361345
	RNIB Ruler	0	0	0	7.964602	13.67521	31.64557
	WT Ruler	0	0	0	10.61947	11.96581	34.21053

	Total	2.564103	2.5	5	24.77876	34.18803	20.63037
Ruler/Protractor resting against wrong pins/Ruler Orientation causing drwaing/measurement errors	APH Clip Ruler	0	0	0	7.964602	7.692308	24
	None	5.128205	0	2.5	0	0	2.521008
	RNIB Ruler	0	0	0	8.849558	6.837607	22.78481
	WT Ruler	0	0	0	4.424779	1.709402	9.210526
	Total	5.128205	0	2.5	21.23894	16.23932	13.18052
Stylus going underneath the protractor/wand/ruler whilst drawing	APH Clip Ruler	0	0	0	0	0	0
	None	43.58974	40	0	0	0	27.73109
	RNIB Ruler	0	0	0	0.884956	0	1.265823
	WT Ruler	0	0	0	2.654867	3.418803	9.210526
	Total	43.58974	40	0	3.539823	3.418803	11.74785
Did not draw till end point	APH Clip Ruler	0	0	0	1.769912	2.564103	6.666667
	None	12.82051	12.5	10	0	0	11.76471
	RNIB Ruler	0	0	0	6.19469	6.837607	18.9873

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	WT Ruler	0	0	0	4.424779	1.709402	9.210526
	Total	12.82051	12.5	10	12.38938	11.11111	11.74785
Gap between pin and ruler/protractor whilst drawing/measurement causing errors	APH Clip Ruler	0	0	0	3.539823	8.547009	18.66667
	None	5.128205	0	0	0	0	1.680672
	RNIB Ruler	0	0	0	7.079646	7.692308	21.51899
	WT Ruler	0	0	0	0.884956	5.128205	9.210526
	Total	5.128205	0	0	11.50442	21.36752	11.46132
Protractor/Ruler movement whilst drawing second arm	APH Clip Ruler	0	0	0	0.884956	2.564103	5.333333
	None	12.82051	32.5	0	0	0	15.12605
	RNIB Ruler	0	0	0	0.884956	4.273504	7.594937
	WT Ruler	0	0	0	5.309735	4.273504	14.47368
	Total	12.82051	32.5	0	7.079646	11.11111	11.17479

Errors/Difficulty in placing point pins on marked TDs/drawings (vertex/on arms)	APH Clip Ruler	0	0	0	1.769912	4.273504	9.333333
	None	17.94872	5	2.5	0	0	8.403361
	RNIB Ruler	0	0	0	7.079646	2.564103	13.92405
	WT Ruler	0	0	0	2.654867	5.128205	11.84211
	Total	17.94872	5	2.5	11.50442	11.96581	10.60172
Protractor slipping under the knob	APH Clip Ruler	0	0	0	7.964602	0	12
	None	0	0	0	0	0	0
	RNIB Ruler	0	0	0	8.849558	0	12.65823
	WT Ruler	0	0	0	11.50442	0	17.10526
	Total	0	0	0	28.31858	0	9.169054
Stylus not touching protractor/wand/ruler when drawing	APH Clip Ruler	0	0	0	1.769912	4.273504	9.333333
	None	20.51282	7.5	0	0	0	9.243697
	RNIB Ruler	0	0	0	3.539823	2.564103	8.860759
	WT Ruler	0	0	0	2.654867	2.564103	7.89473

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	Total	20.51282	7.5	0	7.964602	9.401709	8.882521
Protractor/ Ruler movement whilst drawing baseline	APH Clip Ruler	0	0	0	0.884956	1.709402	4
	None	12.82051	20	0	0	0	10.92437
	RNIB Ruler	0	0	0	3.539823	1.709402	7.594937
	WT Ruler	0	0	0	3.539823	3.418803	10.52632
	Total	12.82051	20	0	7.964602	6.837607	8.595989
Protractor movement whilst immobilizing	APH Clip Ruler	0	0	0	2.654867	3.418803	9.333333
	None	5.128205	0	0	0	0	1.680672
	RNIB Ruler	0	0	0	2.654867	1.709402	6.329114
	WT Ruler	0	0	0	4.424779	7.692308	18.42105
	Total	5.128205	0	0	9.734513	12.82051	8.022923
Struggled in reading measurement/Difficulty in understanding markings	APH Clip Ruler	0	0	0	4.424779	0.854701	8
	None	7.692308	12.5	12.5	0	0	10.92437

	RNIB Ruler	0	0	0	0.884956	1.709402	3.797468
	WT Ruler	0	0	0	0.884956	2.564103	5.263158
	Total	7.692308	12.5	12.5	6.19469	5.128205	7.449857
Drawing not dark enough or long enough	APH Clip Ruler	0	0	0	1.769912	2.564103	6.666667
	None	5.128205	7.5	5	0	0	5.882353
	RNIB Ruler	0	0	0	0.884956	4.273504	7.594937
	WT Ruler	0	0	0	2.654867	3.418803	9.210526
	Total	5.128205	7.5	5	5.309735	10.25641	7.163324
Difficulty in placing the measurement point exactly at the groove/mark	APH Clip Ruler	0	0	0	1.769912	2.564103	6.666667
	None	12.82051	5	0	0	0	5.882353
	RNIB Ruler	0	0	0	1.769912	2.564103	6.329114
	WT Ruler	0	0	0	1.769912	5.128205	10.52632
	Total	12.82051	5	0	5.309735	10.25641	7.16332

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Using wrong side of the ruler	APH Clip Ruler	0	0	0	0	0.854701	1.33333 3
	None	0	0	0	0	0	0
	RNIB Ruler	0	0	0	9.734513	10.25641	29.1139 2
	WT Ruler	0	0	0	0	0	0
	Total	0	0	0	9.734513	11.11111	6.87679 1
Drawing beyond vertex point	APH Clip Ruler	0	0	0	1.769912	0.854701	4
	None	2.564103	2.5	17.5	0	0	7.56302 5
	RNIB Ruler	0	0	0	2.654867	0.854701	5.06329 1
	WT Ruler	0	0	0	0.884956	3.418803	6.57894 7
	Total	2.564103	2.5	17.5	5.309735	5.128205	6.01719 2
Careless counting /Measuring Mistakes	APH Clip Ruler	0	0	0	0.884956	5.982906	10.6666 7
	None	0	7.5	5	0	0	4.20168 1
	RNIB Ruler	0	0	0	1.769912	1.709402	5.06329 1
	WT Ruler	0	0	0	0.884956	1.709402	3.94736

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	Total	0	7.5	5	3.539823	9.401709	5.730659
Wand movement causing drawing/measurement errors	APH Clip Ruler	0	0	0	0	0	0
	None	28.20513	17.5	0	0	0	15.12605
	RNIB Ruler	0	0	0	0	0	0
	WT Ruler	0	0	0	0	0	0
	Total	28.20513	17.5	0	0	0	5.157593
Protractor movement whilst plotting measurement/measurement	APH Clip Ruler	0	0	0	2.654867	0	4
	None	0	0	0	0	0	0
	RNIB Ruler	0	0	0	5.309735	0	7.594937
	WT Ruler	0	0	0	7.079646	0	10.52632
	Total	0	0	0	15.04425	0	4.87106
Struggled in finding Free Space to draw	APH Clip Ruler	0	0	0	0	3.418803	5.333333
	None	5.128205	0	5	0	0	3.361345
	RNIB Ruler	0	0	0	1.769912	1.709402	5.063291
	WT Ruler	0	0	0	2.654867	0.854701	5.263158

	Total	5.128205	0	5	4.424779	5.982906	4.584527
Board Turned to Draw	APH Clip Ruler	0	0	0	0	0.854701	1.333333
	None	5.128205	7.5	7.5	0	0	6.722689
	RNIB Ruler	0	0	0	0.884956	0.854701	2.531646
	WT Ruler	0	0	0	1.769912	1.709402	5.263158
	Total	5.128205	7.5	7.5	2.654867	3.418803	4.297994
Struggled in fixing line marker on point markers and protractor measurement grooves	APH Clip Ruler	0	0	0	0	0	0
	None	0	0	37.5	0	0	12.60504
	RNIB Ruler	0	0	0	0	0	0
	WT Ruler	0	0	0	0	0	0
	Total	0	0	37.5	0	0	4.297994
Errors in measurement due to non-familiarity with 45-90 system	APH Clip Ruler	0	0	0	1.769912	0	2.666667
	None	10.25641	17.5	0	0	0	9.243697
	RNIB Ruler	0	0	0	0	0.854701	1.265823

	WT Ruler	0	0	0	0	0	0
	Total	10.25641	17.5	0	1.769912	0.854701	4.011461
Struggled in Placing the Protractor with right orientation	APH Clip Ruler	0	0	0	0.884956	1.709402	4
	None	7.692308	7.5	0	0	0	5.042017
	RNIB Ruler	0	0	0	0	1.709402	2.531646
	WT Ruler	0	0	0	0	1.709402	2.631579
	Total	7.692308	7.5	0	0.884956	5.128205	3.724928
Difficulty in using Garg Stylus	APH Clip Ruler	0	0	0	0	0	0
	None	0	0	32.5	0	0	10.92437
	RNIB Ruler	0	0	0	0	0	0
	WT Ruler	0	0	0	0	0	0
	Total	0	0	32.5	0	0	3.724928
Struggled Drawing on the sheet	APH Clip Ruler	0	0	0	1.769912	0	2.666667
	None	10.25641	2.5	0	0	0	4.201681
	RNIB Ruler	0	0	0	1.769912	1.709402	5.063291

	WT Ruler	0	0	0	0	0.854701	1.315789
	Total	10.25641	2.5	0	3.539823	2.564103	3.438395
Putting pins off the immobilization grooves of protractor making the protractor move	APH Clip Ruler	0	0	0	0.884956	0	1.333333
	None	15.38462	0	0	0	0	5.042017
	RNIB Ruler	0	0	0	1.769912	0	2.531646
	WT Ruler	0	0	0	2.654867	0	3.947368
	Total	15.38462	0	0	5.309735	0	3.438395
Struggles with (RNIB) Knob	APH Clip Ruler	0	0	0	1.769912	0	2.666667
	None	0	0	0	0	0	0
	RNIB Ruler	0	0	0	7.964602	0	11.39241
	WT Ruler	0	0	0	0.884956	0	1.315789
	Total	0	0	0	10.61947	0	3.438395
Errors in using the short cut for measurement	APH Clip Ruler	0	0	0	2.654867	0	4
	None	10.25641	10	0	0	0	6.72268

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	RNIB Ruler	0	0	0	0	0	0
	WT Ruler	0	0	0	0	0	0
	Total	10.25641	10	0	2.654867	0	3.151862
Line marker moved whilst drawing	APH Clip Ruler	0	0	0	0	0	0
	None	0	0	27.5	0	0	9.243697
	RNIB Ruler	0	0	0	0	0	0
	WT Ruler	0	0	0	0	0	0
	Total	0	0	27.5	0	0	3.151862
Drawing beyond edge of protractor/ruler for baseline	APH Clip Ruler	0	0	0	0.884956	0	1.333333
	None	0	12.5	0	0	0	4.201681
	RNIB Ruler	0	0	0	0	0	0
	WT Ruler	0	0	0	0.884956	2.564103	5.263158
	Total	0	12.5	0	1.769912	2.564103	2.86533
Slipping of protractor at vertex point pin (WT)	APH Clip Ruler	0	0	0	0	1.709402	2.666667
	None	0	0	0	0	0	0
	RNIB Ruler	0	0	0	0	3.418803	5.063291

	WT Ruler	0	0	0	0	2.564103	3.947368
	Total	0	0	0	0	7.692308	2.578797
Difficulty in placing the protractor flat on the point marker	APH Clip Ruler	0	0	0	0	0	0
	None	0	0	12.5	0	0	4.201681
	RNIB Ruler	0	0	0	0	0	0
	WT Ruler	0	0	0	0	0	0
	Total	0	0	12.5	0	0	1.432665

Table 4.1.1 Skill 3: Training Phase: Older (O)-Younger (Y) Variation (%)

		APH Wand- inside Protractor		APH Wand Protractor		Garg Protractor		RNIB Protractor		WT Protractor	
		O	Y	O	Y	O	Y	O	Y	O	Y
Count of Difficulty in straightening the ruler/protractor/point markers for baseline drawing	APH Clip Ruler	0	0	0	0	0	0	11.76471	20	16.66667	25
Count of Difficulty in straightening the ruler/protractor/point markers for baseline drawing	None	15.78947	25	40	35	10	20	0	0	0	0
Count of Protractor/ Ruler movement whilst drawing baseline	None	10.52632	15	10	30	0	0	0	0	0	0
Count of Protractor movement whilst plotting measurement/measurement	RNIB Ruler	0	0	0	0	0	0	21.05263	10	0	0
Count of Protractor movement whilst plotting measurement/measurement	WT Ruler	0	0	0	0	0	0	29.41176	15	0	0
Count of Protractor/Ruler movement whilst drawing second arm	RNIB Ruler	0	0	0	0	0	0	0	5	0	25
Count of Protractor/Ruler	WT Ruler	0	0	0	0	0	0	17.64706	15	21.05263	5

movement whilst drawing second arm											
Count of Struggled in aligning protractor to vertex and Baseline	RNIB Ruler	0	0	0	0	0	0	31.57895	15	30	50
Count of Struggled in reading measurement/Difficulty in understanding markings	APH Clip Ruler	0	0	0	0	0	0	0	25	0	0
Count of Struggled in reading measurement/Difficulty in understanding markings	None	0	15	15	10	15	10	0	0	0	0
Count of Stylus not touching protractor/wand/ruler when drawing	None	5.263158	35	5	10	0	0	0	0	0	0
Count of Stylus going underneath the protractor/wand/ruler whilst drawing	None	57.89474	30	40	40	0	0	0	0	0	0
Count of Stylus going underneath the protractor/wand/ruler whilst drawing	WT Ruler	0	0	0	0	0	0	5.882353	10	21.05263	0
Count of Errors/Difficulty in placing point pins on marked TDs/drawings (vertex/on	APH Clip Ruler	0	0	0	0	0	0	11.76471	0	5.555556	20

arms)											
Count of Errors/Difficulty in placing point pins on marked TDs/drawings (vertex/on arms)	WT Ruler	0	0	0	0	0	0	5.882353	10	10.52632	20
Count of Drawing beyond vertex point	None	0	5	5	0	25	10	0	0	0	0
Count of Drawing beyond vertex point	WT Ruler	0	0	0	0	0	0	5.882353	0	15.78947	5
Count of Drawing beyond edge of protractor/ruler for baseline	None	0	0	20	5	0	0	0	0	0	0
Count of Errors in using the short cut for measurement	None	10.52632	10	20	0	0	0	0	0	0	0
Count of Did not draw till end point	None	15.78947	10	20	5	15	5	0	0	0	0
Count of Did not draw till end point	RNIB Ruler	0	0	0	0	0	0	10.52632	25	20	20
Count of Did not draw till end point	WT Ruler	0	0	0	0	0	0	23.52941	5	5.263158	5
Count of Gap between pin and ruler/protractor whilst drawing/measurement causing errors	APH Clip Ruler	0	0	0	0	0	0	5.882353	15	16.66667	35
Count of Gap between pin	None	5.263158	5	0	0	0	0	0	0	0	0

and ruler/protractor whilst drawing/measurement causing errors											
Count of Gap between pin and ruler/protractor whilst drawing/measurement causing errors	RNIB Ruler	0	0	0	0	0	0	15.78947	25	30	15
Count of Protractor movement whilst immobilizing	APH Clip Ruler	0	0	0	0	0	0	0	15	11.11111	10
Count of Difficulty in placing the wand exactly at the groove/mark	None	5.263158	20	5	5	0	0	0	0	0	0
Count of Difficulty in placing the measurement point exactly at the groove/mark	RNIB Ruler	0	0	0	0	0	0	0	10	15	0
Count of Ruler/Protractor resting against wrong pins/Ruler Orientation causing drawing/measurement errors	WT Ruler	0	0	0	0	0	0	0	25	5.263158	5
Count of Using wrong side of the ruler	RNIB Ruler	0	0	0	0	0	0	21.05263	35	35	25
Count of Errors in measurement due to non-	None	10.52632	10	30	5	0	0	0	0	0	0

[illegible]

Table 4.2: Skill 3: Key Issues: Test Phase (%)

		APH Wand- inside Protract or Total	APH Wand Protract or Total	Garg Protract or Total	RNIB Protract or Total	WT Protract or Total	Grand Total
Struggled in aligning protractor to vertex and Baseline	APH Clip Ruler	0	0	0	16.6666 7	11.6666 7	42.5
	None	5	2.5	0	0	0	2.5
	RNIB Ruler	0	0	0	13.3333 3	13.3333 3	40
	WT Ruler	0	0	0	15	13.3333 3	42.5
	Total	5	2.5	0	45	38.3333 3	28.6111 1
Difficulty in straightening the ruler/protractor/point markers for baseline drawing	APH Clip Ruler	0	0	0	10	7.5	26.25
	None	12.5	40	30	0	0	27.5
	RNIB Ruler	0	0	0	7.5	5	18.75
	WT Ruler	0	0	0	10.8333 3	12.5	35
	Total	12.5	40	30	28.3333	25	26.9444

					3		4
Did not draw till end point	APH Clip Ruler	0	0	0	5.83333 3	3.33333 3	13.75
	None	25	25	10	0	0	20
	RNIB Ruler	0	0	0	7.5	5.83333 3	20
	WT Ruler	0	0	0	5	3.33333 3	12.5
	Total	25	25	10	18.3333 3	12.5	16.9444 4
Errors/Difficulty in placing point pins on marked TDs/drawings (vertex/on arms)	APH Clip Ruler	0	0	0	4.16666 7	5	13.75
	None	12.5	5	5	0	0	7.5
	RNIB Ruler	0	0	0	5.83333 3	6.66666 7	18.75
	WT Ruler	0	0	0	9.16666 7	9.16666 7	27.5
	Total	12.5	5	5	19.1666 7	20.8333 3	15.8333 3
Ruler/Protractor resting against wrong pins/Ruler Orientation causing drawing/measurement errors	APH Clip Ruler	0	0	0	8.33333 3	8.33333 3	25
	None	12.5	0	0	0	0	4.16666

							7
	RNIB Ruler	0	0	0	3.333333	5	12.5
	WT Ruler	0	0	0	2.5	3.333333	8.75
	Total	12.5	0	0	14.16667	16.66667	11.66667
Cannot be Assessed	APH Clip Ruler	0	0	0	2.5	3.333333	8.75
	None	20	15	15	0	0	16.66667
	RNIB Ruler	0	0	0	4.166667	1.666667	8.75
	WT Ruler	0	0	0	3.333333	3.333333	10
	Total	20	15	15	10	8.333333	11.66667
Careless counting /Measuring Mistakes	APH Clip Ruler	0	0	0	4.166667	2.5	10
	None	12.5	22.5	15	0	0	16.66667
	RNIB Ruler	0	0	0	0.833333	5.833333	10

	WT Ruler	0	0	0	0.833333	1.666667	3.75
	Total	12.5	22.5	15	5.833333	10	10.833333
Stylus not touching protractor/wand/ruler when drawing	APH Clip Ruler	0	0	0	3.333333	1.666667	7.5
	None	17.5	10	0	0	0	9.166667
	RNIB Ruler	0	0	0	2.5	5.833333	12.5
	WT Ruler	0	0	0	4.166667	4.166667	12.5
	Total	17.5	10	0	10	11.666667	10.277778
Struggled in Placing the Protractor with right orientation	APH Clip Ruler	0	0	0	2.5	3.333333	8.75
	None	12.5	32.5	2.5	0	0	15.833333
	RNIB Ruler	0	0	0	0.833333	2.5	5
	WT Ruler	0	0	0	2.5	1.666667	6.25
	Total	12.5	32.5	2.5	5.833333	7.5	9.722222

					3		2
Difficulty in placing the measurement point exactly at the groove/mark	APH Clip Ruler	0	0	0	1.666667	3.333333	7.5
	None	37.5	15	0	0	0	17.5
	RNIB Ruler	0	0	0	0.833333	0.833333	2.5
	WT Ruler	0	0	0	1.666667	1.666667	5
	Total	37.5	15	0	4.166667	5.833333	9.166667
Protractor/Ruler movement whilst drawing second arm	APH Clip Ruler	0	0	0	3.333333	2.5	8.75
	None	15	20	0	0	0	11.66667
	RNIB Ruler	0	0	0	1.666667	0.833333	3.75
	WT Ruler	0	0	0	2.5	4.166667	10
	Total	15	20	0	7.5	7.5	8.888889
Stylus going underneath the protractor/wand/ruler whilst drawing	APH Clip Ruler	0	0	0	0.833333	0	1.25

	None	25	22.5	0	0	0	15.83333
	RNIB Ruler	0	0	0	0	0	0
	WT Ruler	0	0	0	1.666667	0.833333	3.75
	Total	25	22.5	0	2.5	0.833333	6.388889
Drawing beyond vertex point	APH Clip Ruler	0	0	0	1.666667	3.333333	7.5
	None	2.5	2.5	15	0	0	6.666667
	RNIB Ruler	0	0	0	1.666667	0.833333	3.75
	WT Ruler	0	0	0	3.333333	1.666667	7.5
	Total	2.5	2.5	15	6.666667	5.833333	6.388889
Struggled in finding Free Space to draw	APH Clip Ruler	0	0	0	4.166667	1.666667	8.75
	None	0	2.5	2.5	0	0	1.666667
	RNIB	0	0	0	0	0	0

	Ruler						
	WT Ruler	0	0	0	6.666667	4.166667	16.25
	Total	0	2.5	2.5	10.833333	5.833333	6.111111
Struggles with (RNIB) Knob	APH Clip Ruler	0	0	0	4.166667	0	6.25
	None	0	0	0	0	0	0
	RNIB Ruler	0	0	0	5	0	7.5
	WT Ruler	0	0	0	9.166667	0	13.75
	Total	0	0	0	18.333333	0	6.111111
Protractor movement whilst plotting measurement/measurement	APH Clip Ruler	0	0	0	2.5	1.666667	6.25
	None	0	2.5	0	0	0	0.833333
	RNIB Ruler	0	0	0	2.5	4.166667	10
	WT Ruler	0	0	0	4.166667	0.833333	7.5
	Total	0	2.5	0	9.166666	6.666666	5.555555

					7	7	6
Gap between pin and ruler/protractor whilst drawing/measurement causing errors	APH Clip Ruler	0	0	0	4.166667	1.666667	8.75
	None	7.5	0	0	0	0	2.5
	RNIB Ruler	0	0	0	4.166667	0.833333	7.5
	WT Ruler	0	0	0	1.666667	0.833333	3.75
	Total	7.5	0	0	10	3.333333	5.277778
Drawing not dark enough or long enough	APH Clip Ruler	0	0	0	0.833333	3.333333	6.25
	None	2.5	12.5	7.5	0	0	7.5
	RNIB Ruler	0	0	0	0	0.833333	1.25
	WT Ruler	0	0	0	0.833333	2.5	5
	Total	2.5	12.5	7.5	1.666667	6.666667	5.277778
Protractor slipping under the knob	APH Clip Ruler	0	0	0	3.333333	0	5
	None	0	0	0	0	0	0

	RNIB Ruler	0	0	0	4.166667	0	6.25
	WT Ruler	0	0	0	7.5	0	11.25
	Total	0	0	0	15	0	5
Protractor/ Ruler movement whilst drawing baseline	APH Clip Ruler	0	0	0	0	0.833333	1.25
	None	7.5	5	0	0	0	4.166667
	RNIB Ruler	0	0	0	2.5	2.5	7.5
	WT Ruler	0	0	0	0.833333	2.5	5
	Total	7.5	5	0	3.333333	5.833333	4.444444
Right by Fluke	APH Clip Ruler	0	0	0	1.666667	0.833333	3.75
	None	10	5	0	0	0	5
	RNIB Ruler	0	0	0	1.666667	1.666667	5
	WT Ruler	0	0	0	2.5	0	3.75
	Total	10	5	0	5.833333	2.5	4.444444

					3		4
Struggled in fixing line marker on point markers and protractor measurement grooves	APH Clip Ruler	0	0	0	0	0	0
	None	0	0	37.5	0	0	12.5
	RNIB Ruler	0	0	0	0	0	0
	WT Ruler	0	0	0	0	0	0
	Total	0	0	37.5	0	0	4.166667
Board Turned to Draw	APH Clip Ruler	0	0	0	0.833333	1.666667	3.75
	None	0	2.5	10	0	0	4.166667
	RNIB Ruler	0	0	0	0.833333	0.833333	2.5
	WT Ruler	0	0	0	1.666667	1.666667	5
	Total	0	2.5	10	3.333333	4.166667	3.888889
Using wrong side of the ruler	APH Clip Ruler	0	0	0	0	0	0

	None	0	0	0	0	0	0
	RNIB Ruler	0	0	0	6.666667	5	17.5
	WT Ruler	0	0	0	0	0	0
	Total	0	0	0	6.666667	5	3.888889
Wand movement causing drawing/measurement errors	APH Clip Ruler	0	0	0	0	0	0
	None	17.5	17.5	0	0	0	11.666667
	RNIB Ruler	0	0	0	0	0	0
	WT Ruler	0	0	0	0	0	0
	Total	17.5	17.5	0	0	0	3.888889
Found 3 pin method for APH Wand-inside protractor confusing	APH Clip Ruler	0	0	0	0	0	0
	None	30	0	0	0	0	10
	RNIB Ruler	0	0	0	0	0	0
	WT	0	0	0	0	0	0

	Ruler						
	Total	30	0	0	0	0	3.333333
Slipping of protractor at vertex point pin (WT)	APH Clip Ruler	0	0	0	0	1.666667	2.5
	None	0	0	0	0	0	0
	RNIB Ruler	0	0	0	0	4.166667	6.25
	WT Ruler	0	0	0	0	2.5	3.75
	Total	0	0	0	0	8.333333	2.777778
Struggled in reading measurement/Difficulty in understanding markings	APH Clip Ruler	0	0	0	0	0	0
	None	7.5	2.5	2.5	0	0	4.166667
	RNIB Ruler	0	0	0	0.833333	0	1.25
	WT Ruler	0	0	0	0.833333	0	1.25
	Total	7.5	2.5	2.5	1.666667	0	1.944444
Difficulty in using Garg Stylus	APH	0	0	0	0	0	0

	Clip Ruler						
	None	0	0	17.5	0	0	5.833333
	RNIB Ruler	0	0	0	0	0	0
	WT Ruler	0	0	0	0	0	0
	Total	0	0	17.5	0	0	1.944444
Difficulty in placing the protractor flat on the point marker	APH Clip Ruler	0	0	0	0	0	0
	None	0	0	15	0	0	5
	RNIB Ruler	0	0	0	0	0	0
	WT Ruler	0	0	0	0	0	0
	Total	0	0	15	0	0	1.666667
Point markers moving after drawing baseline	APH Clip Ruler	0	0	0	0	0	0
	None	0	0	15	0	0	5
	RNIB	0	0	0	0	0	0

	Ruler						
	WT Ruler	0	0	0	0	0	0
	Total	0	0	15	0	0	1.66666 7

Table 4.2.1 Skill 3: Test Phase: Older (O)-Younger (Y) Variation (%)

		APH Wand- inside Protract or		APH Wand Protract or		Garg Protract or		RNIB Protract or		WT Protract or	
		Older	Young er	Older	Young er	Older	Young er	Older	Young er	Older	Young er
Count of Board Turned to Draw	None	0	0	5	0	15	5	0	0	0	0
Count of Struggled in Placing the Protractor with right orientation	APH Clip Ruler	0	0	0	0	0	0	5	10	5	15
Count of Struggled in Placing the Protractor with right orientation	None	5	20	25	40	0	5	0	0	0	0
Count of Struggled in Placing the Protractor with right orientation	WT Ruler	0	0	0	0	0	0	0	15	5	5
Count of Difficulty in straightening the ruler/protractor/point markers for baseline drawing	None	15	10	55	25	30	30	0	0	0	0
Count of Difficulty in straightening the ruler/protractor/point markers for baseline drawing	RNIB Ruler	0	0	0	0	0	0	10	35	15	15
Count of Protractor/ Ruler movement whilst drawing baseline	WT Ruler	0	0	0	0	0	0	5	0	15	0
Count of Protractor/Ruler movement whilst drawing second arm	APH Clip Ruler	0	0	0	0	0	0	15	5	0	15
Count of Protractor/Ruler movement whilst drawing second arm	None	20	10	15	25	0	0	0	0	0	0
Count of Struggled in aligning protractor to vertex and Baseline	APH Clip	0	0	0	0	0	0	45	55	20	50

	Ruler										
Count of Stylus not touching protractor/wand/ruler when drawing	APH Clip Ruler	0	0	0	0	0	0	0	20	5	5
Count of Stylus not touching protractor/wand/ruler when drawing	None	10	25	10	10	0	0	0	0	0	0
Count of Stylus not touching protractor/wand/ruler when drawing	RNIB Ruler	0	0	0	0	0	0	5	10	10	25
Count of Stylus not touching protractor/wand/ruler when drawing	WT Ruler	0	0	0	0	0	0	0	25	5	20
Count of Errors/Difficulty in placing point pins on marked TDs/drawings (vertex/on arms)	None	5	20	10	0	0	10	0	0	0	0
Count of Errors/Difficulty in placing point pins on marked TDs/drawings (vertex/on arms)	RNIB Ruler	0	0	0	0	0	0	20	15	30	10
Count of Errors/Difficulty in placing point pins on marked TDs/drawings (vertex/on arms)	WT Ruler	0	0	0	0	0	0	30	25	40	15
Count of Careless counting /Measuring Mistakes	APH Clip Ruler	0	0	0	0	0	0	20	5	5	10
Count of Drawing beyond vertex point	APH Clip Ruler	0	0	0	0	0	0	0	10	5	15
Count of Drawing beyond vertex point	None	5	0	0	5	20	10	0	0	0	0
Count of Did not draw till end point	APH Clip Ruler	0	0	0	0	0	0	20	15	10	10
Count of Did not draw till end point	None	35	15	25	25	5	15	0	0	0	0
Count of Did not draw till end point	RNIB Ruler	0	0	0	0	0	0	20	25	30	5
Count of Did not draw till end point	WT Ruler	0	0	0	0	0	0	0	30	15	5

Count of Gap between pin and ruler/protractor whilst drawing/measurement causing errors	APH Clip Ruler	0	0	0	0	0	0	20	5	5	5
Count of Gap between pin and ruler/protractor whilst drawing/measurement causing errors	None	0	15	0	0	0	0	0	0	0	0
Count of Gap between pin and ruler/protractor whilst drawing/measurement causing errors	RNIB Ruler	0	0	0	0	0	0	20	5	0	5
Count of Drawing not dark enough or long enough	WT Ruler	0	0	0	0	0	0	5	0	0	15
Count of Difficulty in placing the measurement point exactly at the groove/mark	None	45	30	10	20	0	0	0	0	0	0
Count of Ruler/Protractor resting against wrong pins/Ruler Orientation causing drwaing/measurement errors	RNIB Ruler	0	0	0	0	0	0	10	10	20	10
Count of Ruler/Protractor resting against wrong pins/Ruler Orientation causing drwaing/measurement errors	WT Ruler	0	0	0	0	0	0	5	10	15	5
Count of Using wrong side of the ruler	RNIB Ruler	0	0	0	0	0	0	25	15	5	25
Count of Protractor slipping under the knob	WT Ruler	0	0	0	0	0	0	15	30	0	0
Count of Point markers moving after drawing baseline	None	0	0	0	0	10	20	0	0	0	0
Count of Stuggles with (RNIB) Knob	APH Clip Ruler	0	0	0	0	0	0	20	5	0	0
Count of Cannot be Assessed	APH Clip Ruler	0	0	0	0	0	0	10	5	0	20
Count of Cannot be Assessed	None	10	30	10	20	15	15	0	0	0	0

Count of Cannot be Assessed	RNIB Ruler	0	0	0	0	0	0	5	20	0	10
Count of Cannot be Assessed	WT Ruler	0	0	0	0	0	0	5	15	5	15

Table 4.3: Skill 4: Key Issues: Training Phase (%)

		APH Wand Outside Protractor	Garg Protract or	RNIB Protracto r	WT Protract or	Grand Total
Struggled in aligning protractor to vertex and Baseline	Paper Total	11.66667	5	10	15.57789	29.5
	Plastic Sheet Total	10	0	10	14.07035	32.7044
	Thermoform Total	15.83333	0	9.166667	11.05528	43.33333
	Grand Total	37.5	5	29.16667	40.70352	34.02923
Careless counting /Measuring Mistakes	Paper Total	4.166667	17.5	5.833333	9.045226	18.5
	Plastic Sheet Total	8.333333	0	8.333333	10.55276	25.78616
	Thermoform Total	4.166667	0	9.166667	6.532663	24.16667
	Grand Total	16.66667	17.5	23.33333	26.13065	22.3382
Errors/Difficulty in placing point pins on marked TDs/drawings (vertex/on arms)	Paper Total	5.833333	45	1.666667	4.522613	18
	Plastic	6.666667	0	10.83333	7.53768	22.641

	Sheet Total				8	51
	Thermoform Total	0	0	5.833333	0	5.833333
	Grand Total	12.5	45	18.33333	12.0603	16.49269
Protractor movement whilst plotting measurement/measurement	Paper Total	0.833333	2.5	1.666667	3.517588	5.5
	Plastic Sheet Total	0.833333	0	3.333333	4.522613	8.805031
	Thermoform Total	1.666667	0	2.5	2.01005	7.5
	Grand Total	3.333333	2.5	7.5	10.05025	7.098121
Difficulty aligning wand to second arm pins	Paper Total	6.666667	0	0	0	4
	Plastic Sheet Total	9.166667	0	0	0	6.918239
	Thermoform Total	5	0	0	0	5
	Grand Total	20.83333	0	0	0	5.219207
Struggled in Placing the Protractor with right orientation	Paper	1.666667	2.5	0.833333	0.50251	2.5

	Total				3	
	Plastic Sheet Total	5	0	1.666667	0.502513	5.660377
	Thermoform Total	4.166667	0	2.5	1.005025	8.333333
	Grand Total	10.833333	2.5	5	2.01005	5.010438
Struggled in reading measurement/Difficulty in understanding markings	Paper Total	0.833333	12.5	0	1.507538	4.5
	Plastic Sheet Total	1.666667	0	0.833333	1.005025	3.144654
	Thermoform Total	1.666667	0	2.5	1.507538	6.666667
	Grand Total	4.166667	12.5	3.333333	4.020101	4.592902
Errors in using the short cut for measurement	Paper Total	2.5	0	0.833333	0.502513	2.5
	Plastic Sheet Total	2.5	0	0.833333	0	2.515723
	Thermoform Total	5.833333	0	0	0	5.833333
	Grand	10.833333	0	1.666667	0.50251	3.3402

	Total				3	92
Errors in measurement due to non-familiarity with 45-90 system	Paper Total	2.5	0	0	0	1.5
	Plastic Sheet Total	2.5	0	0.833333	0	2.515723
	Thermoform Total	5.833333	0	0	0	5.833333
	Grand Total	10.83333	0	0.833333	0	2.922756
Protractor slipping under the knob	Paper Total	0	0	3.333333	0	2
	Plastic Sheet Total	0	0	5.833333	0	4.402516
	Thermoform Total	0	0	1.666667	0	1.666667
	Grand Total	0	0	10.83333	0	2.713987
Wand movement causing drawing/measurement errors	Paper Total	3.333333	0	0	0	2
	Plastic Sheet Total	5.833333	0	0	0	4.402516
	Thermoform	1.666667	0	0	0	1.6666

	m Total					67
	Grand Total	10.83333	0	0	0	2.713987
Struggled in fixing line marker on point markers and protractor measurement grooves	Paper Total	0	30	0	0	6
	Plastic Sheet Total	0	0	0	0	0
	Thermoform Total	0	0	0	0	0
	Grand Total	0	30	0	0	2.505219
Slipping of protractor at vertex point pin (WT)	Paper Total	0	0	0	1.507538	1.5
	Plastic Sheet Total	0	0	0	3.517588	4.402516
	Thermoform Total	0	0	0	0	0
	Grand Total	0	0	0	5.025126	2.087683
Pin/clip little off and guessing measure	Paper Total	0.833333	0	0	2.01005	2.5
	Plastic Sheet	0	0	0	1.005025	1.257862

	Total					
	Thermoform Total	0.833333	0	1.666667	0	2.5
	Grand Total	1.666667	0	1.666667	3.015075	2.087683
Struggles with (RNIB) Knob	Paper Total	0	0	3.333333	0	2
	Plastic Sheet Total	0	0	2.5	0	1.886792
	Thermoform Total	0	0	1.666667	0	1.666667
	Grand Total	0	0	7.5	0	1.878914
Struggled in Immobilizing the paper	Paper Total	0	15	0	0	3
	Plastic Sheet Total	0	0	0	1.005025	1.257862
	Thermoform Total	0	0	0	0	0
	Grand Total	0	15	0	1.005025	1.670146
Protractor movement whilst immobilizing	Paper Total	0	0	0	2.01005	2

	Plastic Sheet Total	0	0	0	2.01005	2.515723
	Thermoform Total	0	0	0	0	0
	Grand Total	0	0	0	4.020101	1.670146
TDs not distinct enough	Paper Total	0.833333	0	0	0.502513	1
	Plastic Sheet Total	0	0	0.833333	2.01005	3.144654
	Thermoform Total	0	0	0	0.502513	0.833333
	Grand Total	0.833333	0	0.833333	3.015075	1.670146
Difficulty in placing the measurement point exactly at the groove/mark	Paper Total	0.833333	0	0	0.502513	1
	Plastic Sheet Total	0.833333	0	0	1.507538	2.515723
	Thermoform Total	0.833333	0	0	0	0.833333
	Grand Total	2.5	0	0	2.01005	1.461378

Struggled in measuring because the TD size was small and protractor covered the second arm	Paper Total	0.833333	0	3.333333	0	2.5
	Plastic Sheet Total	0	0	1.666667	0	1.257862
	Thermoform Total	0	0	0	0	0
	Grand Total	0.833333	0	5	0	1.461378
Counting the start point mark as 1 instead of 0	Paper Total	0.833333	0	0	0	0.5
	Plastic Sheet Total	0.833333	0	0	0.502513	1.257862
	Thermoform Total	2.5	0	0	0	2.5
	Grand Total	4.166667	0	0	0.502513	1.25261
Ruler/Protractor resting against wrong pins/Ruler Orientation causing drawing/measurement errors	Paper Total	1.666667	0	0.833333	0	1.5
	Plastic Sheet Total	1.666667	0	0.833333	0	1.886792
	Thermoform Total	0	0	0	0	0

	Grand Total	3.333333	0	1.666667	0	1.25261
Difficulty in placing the protractor flat on the point marker	Paper Total	0	15	0	0	3
	Plastic Sheet Total	0	0	0	0	0
	Thermoform Total	0	0	0	0	0
	Grand Total	0	15	0	0	1.25261
Aligning the wrong tip of the protractor to the vertex point	Paper Total	0	0	0	1.005025	1
	Plastic Sheet Total	0	0	0	1.005025	1.257862
	Thermoform Total	0	0	0	0.502513	0.833333
	Grand Total	0	0	0	2.512563	1.043841

Table 4.3.1 Skill 4: Training Phase: Older (O)-Younger (Y) Variation (%)

			APH Wand Outside Protract or	Garg Protract or	RNIB Protract or	WT Protract or
Count of Struggled in Placing the Protractor with right orientation	Plastic Sheet	O	20	0	0	0
Count of Struggled in Placing the Protractor with right orientation		Y	10	0	10	2.564103
Count of Protractor movement whilst plotting measurement/measurement	Plastic Sheet	O	5	0	0	10
Count of Protractor movement whilst plotting measurement/measurement		Y	0	0	20	12.82051
Count of Struggled in aligning protractor to vertex and Baseline	Plastic Sheet	O	40	0	30	30
Count of Struggled in aligning protractor to vertex and Baseline		Y	20	0	30	41.02564
Count of Protractor slipping under the knob	Plastic Sheet	O	0	0	10	0
Count of Protractor slipping under the knob		Y	0	0	25	0
Count of Wand movement causing drawing/measurement errors	Plastic Sheet	O	10	0	0	0
Count of Wand movement causing drawing/measurement errors		Y	25	0	0	0
Count of Difficulty aligning wand to second arm pins	Plastic Sheet	O	40	0	0	0
Count of Difficulty aligning wand to second arm pins		Y	15	0	0	0
Count of Tds not distinct enough	Plastic	O	0	0	0	2.5

	Sheet					
Count of Tds not distinct enough		Y	0	0	5	7.692308
Count of Protractor movement whilst plotting measurement/measurement	Paper	O	5	5	5	5
Count of Protractor movement whilst plotting measurement/measurement		Y	0	0	5	12.5
Count of Struggled in aligning protractor to vertex and Baseline	Paper	O	30	5	25	30
Count of Struggled in aligning protractor to vertex and Baseline		Y	40	5	35	47.5
Count of Struggled in reading measurement/Difficulty in understanding markings	Paper	O	0	5	0	2.5
Count of Struggled in reading measurement/Difficulty in understanding markings		Y	5	20	0	5
Count of Errors/Difficulty in placing point pins on marked TDs/drawings (vertex/on arms)	Paper	O	25	40	5	10
Count of Errors/Difficulty in placing point pins on marked TDs/drawings (vertex/on arms)		Y	10	50	5	12.5
Count of Careless counting /Measuring Mistakes	Paper	O	5	10	15	20
Count of Careless counting /Measuring Mistakes		Y	20	25	20	25
Count of Errors in using the short cut for measurement	Paper	O	0	0	0	0
Count of Errors in using the short cut for measurement		Y	15	0	5	2.5
Count of Protractor movement whilst immobilizing	Paper	O	0	0	0	7.5
Count of Protractor movement whilst immobilizing		Y	0	0	0	2.5
Count of Errors in measurement due to non familiarity with 45-90 system	Paper	O	0	0	0	0
Count of Errors in measurement due to non familiarity with 45-90 system		Y	15	0	0	0

Count of Slipping of potractor at vertex point pin (WT)	Paper	O	0	0	0	0
Count of Slipping of potractor at vertex point pin (WT)		Y	0	0	0	7.5
Count of Stuggles with (RNIB) Knob	Paper	O	0	0	5	0
Count of Stuggles with (RNIB) Knob		Y	0	0	15	0
Count of Wand movement causing drawing/measurmnt errors	Paper	O	0	0	0	0
Count of Wand movement causing drawing/measurmnt errors		Y	20	0	0	0
Count of Struggled in measuring because the TD size was small and protractor covered the second arm	Paper	O	0	0	5	0
Count of Struggled in measuring because the TD size was small and protractor covered the second arm		Y	5	0	15	0
Count of Protractor movement whilst plotting measurement/measurement	Thermoform	O	0	0	5	5
Count of Protractor movement whilst plotting measurement/measurement		Y	10	0	10	15
Count of Struggled in aligning protractor to vertex and Baseline	Thermoform	O	35	0	20	45
Count of Struggled in aligning protractor to vertex and Baseline		Y	60	0	35	65
Count of Errors/Difficulty in placing point pins on marked TDs/drawings (vertex/on arms)	Thermoform	O	0	0	10	0
Count of Errors/Difficulty in placing point pins on marked TDs/drawings (vertex/on arms)		Y	0	0	25	0
Count of Careless counting /Measuring Mistakes	Thermoform	O	5	0	25	30
Count of Careless counting /Measuring Mistakes		Y	20	0	30	35
Count of Errors in using the short cut for measurement	Thermoform	O	5	0	0	0
Count of Errors in using the short cut for measurement		Y	30	0	0	0

Count of Errors in measurement due to non familiarity with 45-90 system	Thermoform	O	5	0	0	0
Count of Errors in measurement due to non familiarity with 45-90 system		Y	30	0	0	0
Count of Difficulty aligning wand to second arm pins	Thermoform	O	20	0	0	0
Count of Difficulty aligning wand to second arm pins		Y	10	0	0	0

Table 4.4: Skill 4: Key Issues: Test Phase (%)

		APH Wand Outside Protractor	Garg Protractor	RNIB Protractor	WT Protractor	Total
Struggled in aligning protractor to vertex and Baseline	Paper Total	15.83333	17.5	11.66667	24.47917	44.38776
	Plastic Sheet Total	16.66667	0	15.83333	17.70833	46.79487
	Thermoform Total	8.333333	0	14.16667	10.41667	39.16667
	Grand Total	40.83333	17.5	41.66667	52.60417	43.85593
Careless counting /Measuring Mistakes	Paper Total	7.5	17.5	7.5	6.25	18.87755
	Plastic Sheet Total	2.5	0	5.833333	8.333333	16.66667
	Thermoform Total	7.5	0	7.5	4.166667	21.66667

	Grand Total	17.5	17.5	20.83333	18.75	18.85593
Errors/Difficulty in placing point pins on marked TDs/drawings (vertex/on arms)	Paper Total	5	47.5	5	2.604167	18.36735
	Plastic Sheet Total	5	0	7.5	1.5625	11.53846
	Thermoform Total	0	0	2.5	0	2.5
	Grand Total	10	47.5	15	4.166667	12.07627
Difficulty aligning wand to second arm pins	Paper Total	15	0	0	0	9.183673
	Plastic Sheet Total	15.83333	0	0	0	12.17949
	Thermoform Total	16.66667	0	0	0	16.66667
	Grand Total	47.5	0	0	0	12.07627
Struggled in Placing the Protractor with right orientation	Paper Total	3.333333	12.5	0.833333	2.604167	7.653061
	Plastic Sheet Total	3.333333	0	1.666667	5.208333	10.25641
	Thermoform Total	4.166667	0	0.833333	2.604167	9.166667
	Grand Total	10.83333	12.5	3.333333	10.41667	8.898305
Right by Fluke	Paper Total	0.833333	7.5	2.5	2.604167	6.122449

	Plastic Sheet Total	0	0	4.166667	2.083333	5.769231
	Thermoform Total	2.5	0	0.833333	0.520833	4.166667
	Grand Total	3.333333	7.5	7.5	5.208333	5.508475
Pin/clip little off and guessing measure	Paper Total	2.5	0	2.5	2.083333	5.102041
	Plastic Sheet Total	0	0	3.333333	1.5625	4.487179
	Thermoform Total	2.5	0	0.833333	1.041667	5
	Grand Total	5	0	6.666667	4.6875	4.872881
Protractor movement whilst plotting measurement/measurement	Paper Total	0	7.5	0	2.604167	4.081633
	Plastic Sheet Total	0	0	0.833333	3.125	4.487179
	Thermoform Total	0.833333	0	2.5	1.5625	5.833333
	Grand Total	0.833333	7.5	3.333333	7.291667	4.661017
Struggles with (RNIB) Knob	Paper Total	0	0	3.333333	0	2.040816
	Plastic Sheet Total	0	0	3.333333	0	2.564103
	Thermoform Total	0	0	5	0	5

	Grand Total	0	0	11.66667	0	2.966102
Protractor slipping under the knob	Paper Total	0	0	3.333333	0	2.040816
	Plastic Sheet Total	0	0	5	0	3.846154
	Thermoform Total	0	0	2.5	0	2.5
	Grand Total	0	0	10.83333	0	2.754237
Errors in using the short cut for measurement	Paper Total	2.5	0	0	0.520833	2.040816
	Plastic Sheet Total	2.5	0	1.666667	0	3.205128
	Thermoform Total	1.666667	0	0.833333	0	2.5
	Grand Total	6.666667	0	2.5	0.520833	2.542373
Difficulty in placing the protractor flat on the point marker	Paper Total	0	30	0	0	6.122449
	Plastic Sheet Total	0	0	0	0	0
	Thermoform Total	0	0	0	0	0
	Grand Total	0	30	0	0	2.542373
Slipping of protractor at vertex point pin (WT)	Paper Total	0	0	0	1.5625	1.530612

	Plastic Sheet Total	0	0	0	4.166667	5.128205
	Thermoform Total	0	0	0	0	0
	Grand Total	0	0	0	5.729167	2.330508
Struggled in fixing line marker on point markers and protractor measurement grooves	Paper Total	0	22.5	0	0	4.591837
	Plastic Sheet Total	0	0	0	0	0
	Thermoform Total	0	0	0	0	0
	Grand Total	0	22.5	0	0	1.90678
Aligning the wrong tip of the protractor to the vertex point	Paper Total	0	0	0	1.041667	1.020408
	Plastic Sheet Total	0	0	0	1.5625	1.923077
	Thermoform Total	0	0	0	1.5625	2.5
	Grand Total	0	0	0	4.166667	1.694915
Errors in measurement due to non-familiarity with 45-90 system	Paper Total	2.5	0	0	0	1.530612
	Plastic Sheet Total	2.5	0	0	0	1.923077
	Thermoform Total	0.833333	0	0.833333	0	1.666667
	Grand Total	5.833333	0	0.833333	0	1.69491

						5
Cannot be Assessed	Paper Total	2.5	2.5	0	0	2.040816
	Plastic Sheet Total	0.833333	0	0	0	0.641026
	Thermoform Total	0.833333	0	0	0	0.833333
	Grand Total	4.166667	2.5	0	0	1.271186

Table 4.4.1 Skill 4: Test Phase: Older (O)-Younger (Y) Variation (%)

			APH Wand Outside Protractor	Garg Protractor	RNIB Protractor	WT Protractor
Count of Struggled in Placing the Protractor with right orientation	Paper	Older	10.52632	10.52632	5.263158	2.941176
Count of Struggled in Placing the Protractor with right orientation		Younger	9.52381	14.28571	0	9.52381
Count of Struggled in Placing the Protractor with right orientation	Plastic Sheet	Older	15.78947	0	0	14.70588
Count of Struggled in Placing the Protractor with right orientation		Younger	4.761905	0	9.52381	11.90476
Count of Struggled in Placing the Protractor with right orientation	Thermoform	Older	10.52632	0	0	5.263158
Count of Struggled in Placing the Protractor with right orientation		Younger	14.28571	0	4.761905	19.04762
Count of Protractor movement whilst plotting measurement/measurement	Paper	Older	0	0	0	5.882353
Count of Protractor movement whilst plotting measurement/measurement		Younger	0	14.28571	0	7.142857
Count of Protractor movement whilst plotting measurement/measurement	Plastic Sheet	Older	0	0	5.263158	11.76471
Count of Protractor movement whilst plotting measurement/measurement		Younger	0	0	0	4.761905
Count of Protractor movement whilst plotting measurement/measurement	Thermoform	Older	5.263158	0	0	2.941176

Count of Protractor movement whilst plotting measurement/measurement		Younger	0	0	14.28571	4.761905
Count of Struggled in aligning protractor to vertex and Baseline	Paper	Older	36.84211	15.78947	21.05263	61.76471
Count of Struggled in aligning protractor to vertex and Baseline		Younger	57.14286	19.04762	47.61905	61.90476
Count of Struggled in aligning protractor to vertex and Baseline	Plastic Sheet	Older	68.42105	0	42.10526	41.17647
Count of Struggled in aligning protractor to vertex and Baseline		Younger	33.33333	0	52.38095	47.61905
Count of Struggled in aligning protractor to vertex and Baseline	Thermoform	Older	15.78947	0	21.05263	52.63158
Count of Struggled in aligning protractor to vertex and Baseline		Younger	33.33333	0	61.90476	47.61905
Count of Errors/Difficulty in placing point pins on marked TDs/drawings (vertex/on arms)	Paper	Older	21.05263	42.10526	15.78947	5.882353
Count of Errors/Difficulty in placing point pins on marked TDs/drawings (vertex/on arms)		Younger	9.52381	52.38095	14.28571	7.142857
Count of Errors/Difficulty in placing point pins on marked TDs/drawings (vertex/on arms)	Plastic Sheet	Older	21.05263	0	15.78947	2.941176
Count of Errors/Difficulty in placing point pins on marked TDs/drawings (vertex/on arms)		Younger	9.52381	0	28.57143	4.761905
Count of Careless counting /Measuring Mistakes	Paper	Older	21.05263	5.263158	15.78947	8.823529
Count of Careless counting /Measuring Mistakes		Younger	23.80952	28.57143	28.57143	21.42857
Count of Careless counting /Measuring Mistakes	Plastic Sheet	Older	0	0	21.05263	20.58824
Count of Careless counting /Measuring Mistakes		Younger	14.28571	0	14.28571	21.42857
Count of Errors in using the short cut for measurement	Paper	Older	0	0	0	0

Count of Errors in using the short cut for measurement		Younger	14.28571	0	0	2.380952
Count of Protractor slipping under the knob	Paper	Older	0	0	5.263158	0
Count of Protractor slipping under the knob		Younger	0	0	14.28571	0
Count of Protractor slipping under the knob	Plastic Sheet	Older	0	0	10.52632	0
Count of Protractor slipping under the knob		Younger	0	0	19.04762	0
Count of Errors in measurement due to non familiarity with 45-90 system	Paper	Older	0	0	0	0
Count of Errors in measurement due to non familiarity with 45-90 system		Younger	14.28571	0	0	0
Count of Struggled in fixing line marker on point markers and protractor measurement grooves	Paper	Older	0	31.57895	0	0
Count of Struggled in fixing line marker on point markers and protractor measurement grooves		Younger	0	14.28571	0	0
Count of Stuggles with (RNIB) Knob	Thermoform	Older	0	0	21.05263	0
Count of Stuggles with (RNIB) Knob		Younger	0	0	9.52381	0
Count of Pin/clip little off and guessing measure	Paper	Older	10.52632	0	0	8.823529
Count of Pin/clip little off and guessing measure		Younger	4.761905	0	14.28571	2.380952
Count of Right by Fluke	Paper	Older	5.263158	10.52632	0	5.882353
Count of Right by Fluke		Younger	0	4.761905	14.28571	7.142857
Count of Right by Fluke	Plastic Sheet	Older	0	0	5.263158	2.941176
Count of Right by Fluke		Younger	0	0	19.04762	7.142857

ANNEXURE J: DATA TABLES FOR CHAPTER 5
Table 5.1: Skill 5: Key Issues: Training Phase (%)

		APH Compass Total	Classmate Compass Total	Garg Compass Total	Worth Trust ruler as a compass Total	Grand Total
Not able to Maintain radius whilst drawing circle	APH Clip Ruler	0	13.75	0	0	55
	NA	5	0	0	7.5	4.166 667
	RNIB Ruler	0	10	0	0	40
	Squirrel Ruler	0	11.875	0	0	47.5
	Worth Trust Ruler	0	12.5	0	0	50
	Total	5	48.125	0	7.5	29.28 571
First Leg of compass coming off whilst drawing circle	APH Clip Ruler	0	4.375	0	0	17.5
	NA	57.5	0	2.5	7.5	22.5
	RNIB Ruler	0	9.375	0	0	37.5
	Squirrel Ruler	0	5.625	0	0	22.5
	Worth Trust Ruler	0	7.5	0	0	30

	Total	57.5	26.875	2.5	7.5	25
Drawing light and not neat	APH Clip Ruler	0	5	0	0	20
	NA	30	0	27.5	35	30.83 333
	RNIB Ruler	0	5	0	0	20
	Squirrel Ruler	0	3.75	0	0	15
	Worth Trust Ruler	0	5.625	0	0	22.5
	Total	30	19.375	27.5	35	24.28 571
Sheet tearing whilst drawing	APH Clip Ruler	0	1.875	0	0	7.5
	NA	2.5	0	27.5	20	16.66 667
	RNIB Ruler	0	1.25	0	0	5
	Squirrel Ruler	0	0.625	0	0	2.5
	Worth Trust Ruler	0	1.25	0	0	5
	Total	2.5	5	27.5	20	10
Paper folding and creasing whilst drawing	APH Clip Ruler	0	1.25	0	0	5

	NA	12.5	0	7.5	10	10
	RNIB Ruler	0	3.125	0	0	12.5
	Squirrel Ruler	0	2.5	0	0	10
	Worth Trust Ruler	0	3.125	0	0	12.5
	Total	12.5	10	7.5	10	10
Ruler movement whilst setting radius	APH Clip Ruler	0	9.375	0	0	37.5
	NA	0	0	0	0	0
	RNIB Ruler	0	1.875	0	0	7.5
	Squirrel Ruler	0	3.125	0	0	12.5
	Worth Trust Ruler	0	0	0	0	0
	Total	0	14.375	0	0	8.214 286
First Leg of compass coming off whilst setting radius	APH Clip Ruler	0	1.875	0	0	7.5
	NA	0	0	0	0	0
	RNIB Ruler	0	3.75	0	0	15
	Squirrel Ruler	0	6.25	0	0	25

	Worth Trust Ruler	0	2.5	0	0	10
	Total	0	14.375	0	0	8.214 286
Struggled with Using stylus	APH Clip Ruler	0	0	0	0	0
	NA	0	0	37.5	15	17.5
	RNIB Ruler	0	0	0	0	0
	Squirrel Ruler	0	0	0	0	0
	Worth Trust Ruler	0	0	0	0	0
	Total	0	0	37.5	15	7.5
Centre/ end point tears causing errors	APH Clip Ruler	0	1.875	0	0	7.5
	NA	12.5	0	0	0	4.166 667
	RNIB Ruler	0	4.375	0	0	17.5
	Squirrel Ruler	0	1.25	0	0	5
	Worth Trust Ruler	0	1.25	0	0	5
	Total	12.5	8.75	0	0	6.785

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Not able to Maintain radius whilst setting radius itself	APH Clip Ruler	0	3.75	0	0	15
	NA	2.5	0	0	2.5	1.666 667
	RNIB Ruler	0	1.875	0	0	7.5
	Squirrel Ruler	0	1.875	0	0	7.5
	Worth Trust Ruler	0	1.875	0	0	7.5
	Total	2.5	9.375	0	2.5	6.071 429
Difficulty locating centre of sheet to draw	APH Clip Ruler	0	0.625	0	0	2.5
	NA	7.5	0	0	12.5	6.666 667
	RNIB Ruler	0	0	0	0	0
	Squirrel Ruler	0	1.875	0	0	7.5
	Worth Trust Ruler	0	2.5	0	0	10
	Total	7.5	5	0	12.5	5.714 286
Braille Reading Skill Limitations	APH Clip	0	0	0	0	0

	Ruler					
	NA	0	0	20	0	6.666 667
	RNIB Ruler	0	0	0	0	0
	Squirrel Ruler	0	5	0	0	20
	Worth Trust Ruler	0	0	0	0	0
	Total	0	5	20	0	5.714 286
Random counting mistakes	APH Clip Ruler	0	0	0	0	0
	NA	20	0	0	5	8.333 333
	RNIB Ruler	0	0.625	0	0	2.5
	Squirrel Ruler	0	0	0	0	0
	Worth Trust Ruler	0	1.25	0	0	5
	Total	20	1.875	0	5	4.642 857
Pen Coming off whilst drawing circle	APH Clip Ruler	0	1.875	0	0	7.5
	NA	0	0	0	0	0

	RNIB Ruler	0	2.5	0	0	10
	Squirrel Ruler	0	1.25	0	0	5
	Worth Trust Ruler	0	2.5	0	0	10
	Total	0	8.125	0	0	4.642 857
Struggled reading marking on the compass	APH Clip Ruler	0	0	0	0	0
	NA	30	0	0	0	10
	RNIB Ruler	0	0	0	0	0
	Squirrel Ruler	0	0	0	0	0
	Worth Trust Ruler	0	0	0	0	0
	Total	30	0	0	0	4.285 714
Struggled in Holding down Ruler with Compass whilst setting radius, leading to movement and errors	APH Clip Ruler	0	3.125	0	0	12.5
	NA	0	0	0	0	0
	RNIB Ruler	0	1.25	0	0	5
	Squirrel Ruler	0	1.25	0	0	5

	Worth Trust Ruler	0	1.25	0	0	5
	Total	0	6.875	0	0	3.928 571
Counting 1 as 0	APH Clip Ruler	0	0	0	0	0
	NA	12.5	0	0	0	4.166 667
	RNIB Ruler	0	0	0	0	0
	Squirrel Ruler	0	0	0	0	0
	Worth Trust Ruler	0	0	0	0	0
	Total	12.5	0	0	0	1.785 714

Table 5.1.1 Skill 5: Training Phase: Older (O)-Younger (Y) Variation (%)

		APH Compass		Classmate Compass		Garg Compass		Worth Trust ruler as a compass	
		Older	Younger	Older	Younger	Older	Younger	Older	Younger
Count of Ruler movement whilst setting radius	Squirrel Ruler	0	0	5	20	0	0	0	0
Count of first Leg of compass coming off whilst setting radius	Worth Trust Ruler	0	0	15	5	0	0	0	0
Count of first Leg of compass coming off whilst drawing circle	RNIB Ruler	0	0	20	55	0	0	0	0
Count of first Leg of compass coming off whilst drawing circle	Worth Trust Ruler	0	0	15	45	0	0	0	0
Count of Pen Coming off whilst drawing circle	RNIB Ruler	0	0	0	20	0	0	0	0
Count of Pen Coming off whilst drawing circle	Worth Trust Ruler	0	0	15	5	0	0	0	0
Count of Drawing light and not neat	Squirrel Ruler	0	0	20	10	0	0	0	0
Count of Drawing light and not neat	Worth Trust Ruler	0	0	15	30	0	0	0	0
Count of Centre/ end point tears causing erros	APH Clip Ruler	0	0	0	15	0	0	0	0
Count of Centre/ end point tears causing erros	RNIB Ruler	0	0	5	30	0	0	0	0
Count of Paper folding and creasing whilst drawing	NA	10	15	0	0	5	10	5	15
Count of Not able to Maintaint radius whilst settnig radius itself	APH Clip Ruler	0	0	20	10	0	0	0	0
Count of Not able to Maintaint radius whilst settnig radius itself	Squirrel Ruler	0	0	15	0	0	0	0	0
Count of Braille Reading Skill Limitations	NA	0	0	0	0	10	30	0	0

Table 5.2: Skill 5: Key Issues: Test Phase (%)

		APH Compass Total	Classmate Compass Total	Garg Compass Total	Worth Trust ruler as a compass Total	Grand Total
Not able to Maintain radius whilst drawing circle	APH Clip Ruler	0	12.5	0	0	50
	NA	10	0	0	10	6.666 667
	RNIB Ruler	0	12.5	0	0	50
	Squirrel Ruler	0	11.25	0	0	45
	Worth Trust Ruler	0	11.25	0	0	45
	Total	10	47.5	0	10	30
Drawing light and not neat	APH Clip Ruler	0	5.625	0	0	22.5
	NA	27.5	0	20	25	24.16 667
	RNIB Ruler	0	6.25	0	0	25
	Squirrel Ruler	0	4.375	0	0	17.5
	Worth Trust Ruler	0	3.75	0	0	15
	Total	27.5	20	20	25	21.78

						571
Difficulty in setting the second leg to the accurate measurement (includes squirrel clip movement)	APH Clip Ruler	0	5.625	0	0	22.5
	NA	25	0	0	5	10
	RNIB Ruler	0	4.375	0	0	17.5
	Squirrel Ruler	0	10	0	0	40
	Worth Trust Ruler	0	5	0	0	20
	Total	25	25	0	5	18.57 143
First Leg of compass coming off whilst drawing circle	APH Clip Ruler	0	6.875	0	0	27.5
	NA	30	0	5	7.5	14.16 667
	RNIB Ruler	0	4.375	0	0	17.5
	Squirrel Ruler	0	3.75	0	0	15
	Worth Trust Ruler	0	2.5	0	0	10
	Total	30	17.5	5	7.5	16.07 143
Paper folding and creasing whilst drawing	APH Clip Ruler	0	1.875	0	0	7.5

	NA	5	0	15	20	13.33 333
	RNIB Ruler	0	2.5	0	0	10
	Squirrel Ruler	0	3.75	0	0	15
	Worth Trust Ruler	0	1.25	0	0	5
	Total	5	9.375	15	20	11.07 143
Centre/ end point tears causing errors	APH Clip Ruler	0	1.875	0	0	7.5
	NA	17.5	0	2.5	7.5	9.166 667
	RNIB Ruler	0	1.875	0	0	7.5
	Squirrel Ruler	0	2.5	0	0	10
	Worth Trust Ruler	0	1.875	0	0	7.5
	Total	17.5	8.125	2.5	7.5	8.571 429
Random counting mistakes	APH Clip Ruler	0	3.75	0	0	15
	NA	10	0	0	2.5	4.166 667

	RNIB Ruler	0	3.75	0	0	15
	Squirrel Ruler	0	1.25	0	0	5
	Worth Trust Ruler	0	1.875	0	0	7.5
	Total	10	10.625	0	2.5	7.857 143
Difficulty in using the knob on the compass	APH Clip Ruler	0	2.5	0	0	10
	NA	2.5	0	0	0	0.833 333
	RNIB Ruler	0	4.375	0	0	17.5
	Squirrel Ruler	0	1.875	0	0	7.5
	Worth Trust Ruler	0	1.875	0	0	7.5
	Total	2.5	10.625	0	0	6.428 571
Struggled with Using stylus	APH Clip Ruler	0	0	0	0	0
	NA	0	0	32.5	10	14.16 667
	RNIB Ruler	0	0	0	0	0

	Squirrel Ruler	0	0	0	0	0
	Worth Trust Ruler	0	0	0	0	0
	Total	0	0	32.5	10	6.071429
Cannot be assessed	APH Clip Ruler	0	2.5	0	0	10
	NA	7.5	0	2.5	2.5	4.166667
	RNIB Ruler	0	0.625	0	0	2.5
	Squirrel Ruler	0	2.5	0	0	10
	Worth Trust Ruler	0	1.25	0	0	5
	Total	7.5	6.875	2.5	2.5	5.714286
First leg at 0.5 mark causing measurement errors	APH Clip Ruler	0	2.5	0	0	10
	NA	0	0	0	5	1.666667
	RNIB Ruler	0	1.875	0	0	7.5
	Squirrel Ruler	0	0	0	0	0

	Worth Trust Ruler	0	3.75	0	0	15
	Total	0	8.125	0	5	5.357 143
Ruler movement whilst setting radius	APH Clip Ruler	0	3.75	0	0	15
	NA	0	0	0	0	0
	RNIB Ruler	0	3.125	0	0	12.5
	Squirrel Ruler	0	0.625	0	0	2.5
	Worth Trust Ruler	0	0.625	0	0	2.5
	Total	0	8.125	0	0	4.642 857
Difficulty locating centre of sheet to draw	APH Clip Ruler	0	0.625	0	0	2.5
	NA	10	0	7.5	2.5	6.666 667
	RNIB Ruler	0	0	0	0	0
	Squirrel Ruler	0	1.25	0	0	5
	Worth Trust Ruler	0	0.625	0	0	2.5

	Total	10	2.5	7.5	2.5	4.285 714
First Leg of compass coming off whilst setting radius	APH Clip Ruler	0	2.5	0	0	10
	NA	0	0	0	0	0
	RNIB Ruler	0	0	0	0	0
	Squirrel Ruler	0	2.5	0	0	10
	Worth Trust Ruler	0	2.5	0	0	10
	Total	0	7.5	0	0	4.285 714
Braille Reading Skill Limitations	APH Clip Ruler	0	0.625	0	0	2.5
	NA	0	0	10	0	3.333 333
	RNIB Ruler	0	0	0	0	0
	Squirrel Ruler	0	3.125	0	0	12.5
	Worth Trust Ruler	0	0	0	0	0
	Total	0	3.75	10	0	3.571 429
Sheet tearing whilst drawing	APH Clip	0	0	0	0	0

	Ruler					
	NA	2.5	0	7.5	5	5
	RNIB Ruler	0	0.625	0	0	2.5
	Squirrel Ruler	0	0	0	0	0
	Worth Trust Ruler	0	0	0	0	0
	Total	2.5	0.625	7.5	5	2.5
Immobilization pins/clips coming in the way of drawing	APH Clip Ruler	0	0	0	0	0
	NA	0	0	0	15	5
	RNIB Ruler	0	0	0	0	0
	Squirrel Ruler	0	0.625	0	0	2.5
	Worth Trust Ruler	0	0	0	0	0
	Total	0	0.625	0	15	2.5

Table 5.2.1 Skill 5: Test Phase: Older (O)-Younger (Y) Variation (%)

		APH Compass		Classmate Compass		Garg Compass		Worth Trust ruler as a compass	
		Older	Younger	Older	Younger	Older	Younger	Older	Younger
Count of Difficulty locating centre of sheet to draw	NA	5	15	0	0	0	15	0	5
Count of First leg at 0.5 mark causing measurement errors	RNIB Ruler	0	0	15	0	0	0	0	0
Count of random counting mistakes	APH Clip Ruler	0	0	10	20	0	0	0	0
Count of random counting mistakes	NA	15	5	0	0	0	0	5	0
Count of Ruler movement whilst setting radius	APH Clip Ruler	0	0	25	5	0	0	0	0
Count of Difficulty in using the knob on the compass	APH Clip Ruler	0	0	5	15	0	0	0	0
Count of Difficulty in using the knob on the compass	Squirrel Ruler	0	0	15	0	0	0	0	0
Count of first Leg of compass coming off whilst setting radius	APH Clip Ruler	0	0	5	15	0	0	0	0
Count of first Leg of compass coming off whilst setting radius	Squirrel Ruler	0	0	15	5	0	0	0	0
Count of first Leg of compass coming off whilst drawing circle	Squirrel Ruler	0	0	10	20	0	0	0	0
Count of Drawing light and not neat	NA	25	30	0	0	10	30	30	20
Count of Drawing light and not neat	Squirrel Ruler	0	0	30	5	0	0	0	0
Count of Centre/ end point tears causing erros	APH Clip Ruler	0	0	0	15	0	0	0	0

Count of Centre/ end point tears causing erros	NA	25	10	0	0	0	5	5	10
Count of Centre/ end point tears causing erros	Squirrel Ruler	0	0	5	15	0	0	0	0
Count of Centre/ end point tears causing erros	Worth Trust Ruler	0	0	0	15	0	0	0	0
Count of Sheet tearing whilst drawing	NA	5	0	0	0	15	0	10	0
Count of Immobilization pins/clips coming in the way of drawing	NA	0	0	0	0	0	0	10	20
Count of Paper folding and creasing whilst drawing	NA	0	10	0	0	5	25	20	20
Count of Paper folding and creasing whilst drawing	RNIB Ruler	0	0	15	5	0	0	0	0
Count of Paper folding and creasing whilst drawing	Squirrel Ruler	0	0	5	25	0	0	0	0
Count of Not able to Maintaint radius whilst drawing circle	Worth Trust Ruler	0	0	30	60	0	0	0	0
Count of Struggled with Using stylus	NA	0	0	0	0	35	30	15	5
Count of Difficulty in setting the second leg to the accurate measurement (includes quirrel clip movement)	APH Clip Ruler	0	0	15	30	0	0	0	0

Table 5.3: Skill 6: Key Issues: Training Phase (%)

		APH Compass	Classmate Compass	Garg Compass / Arc Compass	Worth Trust Ruler Compass	TOTAL s
Difficulty in identifying intersection points/Placement of pins off mark at intersection point	Grand Total	35	57.5	40	50	45.625
Placement of pins/first leg off mark at end points	Grand Total	20	35	30	40	31.25
Drawing light and not neat (incomplete)	Grand Total	10	15	17.5	25	16.875
Sheet tearing whilst drawing	Grand Total	2.5	7.5	25	25	15
Struggled with Using stylus	Grand Total	2.5	0	35	20	14.375
Stylus going away from ruler/line Marker whilst drawing	Grand Total	15	12.5	5	17.5	12.5
Not able to Maintain radius whilst drawing arc	Grand Total	5	40	0	2.5	11.875
Ruler /Line marker movement at drawing line bisector	Grand Total	10	5	25	0	10
First Leg of compass coming off whilst drawing arc	Grand Total	17.5	17.5	0	2.5	9.375
Difficulty in identifying end points of line segments	Grand Total	7.5	15	2.5	12.5	9.375
Centre/ end point tears causing erros	Grand Total	2.5	12.5	17.5	2.5	8.75

Braille Reading Skill Limitations	Grand Total	0	0	35	0	8.75
Immobilization pins/clips coming in the way of drawing	Grand Total	5	2.5	0	25	8.125
Not able to calculate radius measurement for setting arc	Grand Total	10	10	0	12.5	8.125
Point markers moving whilst drawing/ positioning arc/circle markers	Grand Total	0	0	32.5	0	8.125
Not able to judge radius for setting arc	Grand Total	5	7.5	10	7.5	7.5
Paper folding and creasing whilst drawing	Grand Total	5	7.5	0	15	6.875
Circle/Arc markers not placed fully flat	Grand Total	0	0	27.5	0	6.875
Drawing arcs on outside end of line segments	Grand Total	2.5	5	7.5	10	6.25
Arc drawn is not long enough to create an intersection point	Grand Total	10	5	7.5	2.5	6.25
Drawing over wrong arc markers	Grand Total	0	0	20	0	5
Random counting mistakes	Grand Total	2.5	0	0	10	3.125
Not able to Maintain radius whilst setting radius itself	Grand Total	2.5	5	0	5	3.125
First Leg of compass coming off whilst setting radius	Grand Total	2.5	5	0	2.5	2.5
Difficulty in setting the second leg to the accurate measurement	Grand Total	2.5	0	0	7.5	2.5

Stylus going under the ruler/line marker	Grand Total	0	2.5	2.5	5	2.5
Struggled reading marking on the compass	Grand Total	5	0	2.5	0	1.875
Stylus going off whilst drawing leading to errors when being placed back whilst drawing	Grand Total	0	0	0	7.5	1.875
Difficulty Placing 1st pins in 1st hole of WT Ruler	Grand Total	0	0	0	7.5	1.875
Counting 1 as 0	Grand Total	5	0	0	0	1.25
Difficulty with arc/circle marker moving whilst drawing	Grand Total	0	0	5	0	1.25

Table 5.3.1 Skill 6: Training Phase: Older (O)-Younger (Y) Variation (%)

		APH Compass	Classmate Compass	Garg Compass / Arc Compass	Worth Trust Ruler Compass
Count of random counting mistakes	Older	0	0	0	5
Count of random counting mistakes	Younger	5	0	0	15
Count of first Leg of compass coming off whilst drawing arc	Older	25	15	0	5
Count of first Leg of compass coming off whilst drawing arc	Younger	10	20	0	0
Count of Drawing light and not neat (incomplete)	Older	10	20	15	15
Count of Drawing light and not neat (incomplete)	Younger	10	10	20	35
Count of Centre/ end point tears causing errors	Older	5	0	15	0
Count of Centre/ end point tears causing errors	Younger	0	25	20	5
Count of Sheet tearing whilst drawing	Older	0	0	30	15
Count of Sheet tearing whilst drawing	Younger	5	15	20	35
Count of Immobilization pins/clips coming in the way of drawing	Older	5	5	0	35
Count of Immobilization pins/clips coming in the way of drawing	Younger	5	0	0	15
Count of Paper folding and creasing whilst drawing	Older	0	5	0	10
Count of Paper folding and creasing whilst drawing	Younger	10	10	0	20
Count of Not able to judge radius for setting arc	Older	5	5	10	15
Count of Not able to judge radius for setting arc	Younger	5	10	10	0
Count of Not able to calculate radius	Older	0	0	0	10

measurement for setting arc					
Count of Not able to calculate radius measurement for setting arc	Younger	20	20	0	15
Count of Braille Reading Skill Limitations	Older	0	0	20	0
Count of Braille Reading Skill Limitations	Younger	0	0	50	0
Count of Difficulty in identifying end points of line segments	Older	5	10	5	20
Count of Difficulty in identifying end points of line segments	Younger	10	20	0	5
Count of Difficulty in identifying intersection points/Placement of pins off mark at intersection point	Older	30	75	30	55
Count of Difficulty in identifying intersection points/Placement of pins off mark at intersection point	Younger	40	40	50	45
Count of Arc drawn is not long enough to create an intersection point	Older	5	0	5	5
Count of Arc drawn is not long enough to create an intersection point	Younger	15	10	10	0
Count of Stylus going off whilst drawing leading to errors when being placed back whilst drawing	Older	0	0	0	5
Count of Stylus going off whilst drawing leading to errors when being placed back whilst drawing	Younger	0	0	0	10
Count of Difficulty in setting the second leg to the accurate measurement	Older	0	0	0	10
Count of Difficulty in setting the second leg to the accurate measurement	Younger	5	0	0	5
Count of Stylus going away from ruler/line Marker	Older	25	10	5	25

whilst drawing					
Count of Stylus going away from ruler/line Marker whilst drawing	Younger	5	15	5	10
Count of Ruler /Line marker movement at drawing line bisector	Older	5	10	35	0
Count of Ruler /Line marker movement at drawing line bisector	Younger	15	0	15	0

Table 5.4: Skill 6: Key Issues: Test Phase (%)

		APH Compass	Classmate Compass	Garg Compass / Arc Compass	Worth Trust Ruler Compass	TOTAL
First Leg of compass coming off whilst drawing arc	Total	35	62.5	28.20513	45	42.7673
Drawing light and not neat	Total	37.5	42.5	20.51282	55	38.99371
Immobilization pins/clips coming in the way of drawing	Total	20	17.5	15.38462	35	22.01258
Paper folding and creasing whilst drawing	Total	5	47.5	5.128205	2.5	15.09434
Not able to judge radius for setting arc	Total	5	12.5	20.51282	22.5	15.09434
Not able to calculate radius measurement for setting arc	Total	7.5	7.5	17.94872	15	11.94969
Not able to Maintain radius whilst drawing arc	Total	20	12.5	2.564103	10	11.32075
Struggled with Using stylus	Total	5	2.5	20.51282	17.5	11.32075
Point markers moving whilst drawing/ positioning arc/circle markers	Total	5	12.5	7.692308	17.5	10.69182
Difficulty in identifying intersection points/Placement of pins off mark at intersection point	Total	0	0	23.07692	15	9.433962
Arc drawn is not long enough to create an intersection point	Total	20	15	0	0	8.805031
Placement of pins/first leg off mark at end points	Total	15	12.5	5.128205	2.5	8.805031
Circle/Arc markers not placed fully flat	Total	7.5	12.5	0	2.5	5.660377
Stylus going under the ruler/line marker	Total	0	0	0	20	5.031447
Drawing over wrong arc markers	Total	0	0	20.51282	0	5.031447
Ruler /Line marker movement at drawing line bisector (added to Skill 6)	Total	0	0	17.94872	0	4.402516
Cannot be assessed	Total	0	0	15.38462	0	3.773585

Table 5.4.1 Skill 6: Test Phase: Older (O)-Younger (Y) Variation (%)

		APH Compass	Classmate Compass	Garg Compass / Arc Compass	Worth Trust Ruler Compass
Count of first Leg of compass coming off whilst drawing arc	Older	10	10	0	0
Count of first Leg of compass coming off whilst drawing arc	Younger	30	20	0	0
Count of Drawing light and not neat	Older	15	15	10.52631579	35
Count of Drawing light and not neat	Younger	25	20	20	35
Count of Paper folding and creasing whilst drawing	Older	20	10	0	5
Count of Paper folding and creasing whilst drawing	Younger	20	15	5	15
Count of Struggled with Using stylus	Older	0	0	21.05263158	20
Count of Struggled with Using stylus	Younger	0	0	25	10
Count of Arc drawn is not long enough to create an intersection point	Older	0	10	0	15
Count of Arc drawn is not long enough to create an intersection point	Younger	10	15	15	20
Count of Placement of pins/first leg off mark at end points	Older	35	55	21.05263158	60
Count of Placement of pins/first leg off mark at end points	Younger	40	30	20	50
Count of Circle/Arc markers not placed fully flat	Older	0	0	10.52631579	0
Count of Circle/Arc markers not placed fully flat	Younger	0	0	20	0
Count of Ruler /Line marker movement	Older	10	15	15.78947368	10

at drawing line bisector (added to Skill 6)					
Count of Ruler /Line marker movement at drawing line bisector (added to Skill 6)	Younger	5	0	20	20
Count of Cannot be assessed	Older	0	5	10.52631579	15
Count of Cannot be assessed	Younger	10	20	30	30

ANNEXURE K: DATA TABLES FOR CHAPTER 6**Table 6.1 APH Clip Ruler: Skill 1 Training Key Issues (%)**

Training		APH Clip Ruler
Clip movement at end point plotting	Grand Total	42.5
Drawing before end point	Grand Total	27.5
Drawing after start point	Grand Total	22.5
Ruler movement or going crooked at Measuring and Plotting End point	Grand Total	20
Alignment of end point with inner edge of clip rather than jut out leading to measurement errors	Grand Total	20
Ruler movement at connecting two points	Grand Total	20
Clip movement at drawings	Grand Total	20
Ruler Movement in Centralising the Ruler	Grand Total	17.5
Struggled Drawing on the sheet	Grand Total	15
Ruler Movement at plotting start point	Grand Total	15
Difficulty in straightening the ruler at the start	Grand Total	12.5
Board Turned to Draw	Grand Total	10
Points/point markers/clip not accurately plotted against the marks	Grand Total	10
Braille Reading Skill Limitations	Grand Total	7.5
Braille Reading Difficulty due to Braille Quality	Grand Total	7.5

Table 6.2 APH Clip Ruler: Skill 1 Training O-Y Variation (%)

Training		APH Clip Ruler
Board Turned to Draw	O	20
	Y	0
Difficulty in straightening the ruler at the start	O	5
	Y	20
Drawing after start point	O	5
	Y	40
Drawing before end point	O	15
	Y	40

Table 6.3 APH Clip Ruler: Skill 1 Test Key Issues (%)

Test APH		total
Ruler movement at connecting two points	Total	50
Drawing before end point	Total	27.5
Clip movement at end point plotting	Total	20
Drawing after start point	Total	20
Ruler Movement in Centralising the Ruler	Total	17.5
Alignment of end point with inner edge of clip rather than jut out leading to measurement errors	Total	17.5
Ruler movement or going crooked at Measuring and Plotting End point	Total	15
Points/point markers/clip not accurately plotted against the marks	Total	15

Clip movement at drawings	Total	15
Careless counting mistakes/Measuring mistake	Total	12.5
Difficulty in straightening the ruler at the start	Total	10
Difficulty Understanding markings on the ruler	Total	7.5
Drawing before start point	Total	7.5

Table 6.4. APH Clip Ruler: Skill 1 Test O-Y Variation (%)

Ruler Movement in Centralising the Ruler	Older	5
	Younger	30
Ruler movement or going crooked at Measuring and Plotting End point	Older	10
	Younger	20
Careless counting mistakes/Measuring mistake	Older	20
	Younger	5
Clip movement at end point plotting	Older	15
	Younger	25
Alignment of end point with inner edge of clip rather than jut out leading to measurement errors	Older	5
	Younger	30
Points/point markers/clip not accurately plotted against the marks	Older	20
	Younger	10
Ruler movement at connecting two points	Older	60
	Younger	40
Drawing after start point	Older	25
	Younger	15

Table 6.4. APH Clip Ruler: Skill 2 Training Key Issues (%)

	0	APH Clip Ruler
Errors in placing end point pins on marked TDs	Paper Total	37.5
	Plastic Sheet Total	42.5
	Thermoform Total	5
	Grand Total	28.33333
Points/point markers/clip not accurately plotted against the marks	Paper Total	25
	Plastic Sheet Total	15
	Thermoform Total	12.5
	Grand Total	17.5
Ruler Movement at start point (plotting or during measurement)	Paper Total	15
	Plastic Sheet Total	10
	Thermoform Total	25
	Grand Total	16.66667
Careless counting mistakes/Measuring mistake	Paper Total	12.5
	Plastic Sheet Total	5
	Thermoform Total	22.5
	Grand Total	13.33333
Gap between Ruler and line	Paper Total	5
	Plastic Sheet Total	15
	Thermoform Total	15
	Grand Total	11.66667
Using wrong side of the ruler	Paper Total	5
	Plastic Sheet Total	12.5
	Thermoform Total	7.5
	Grand Total	8.333333
Ruler movement or going crooked at Measuring and Plotting End point	Paper Total	7.5

	Plastic Sheet Total	7.5
	Thermoform Total	5
	Grand Total	6.666667
Students Counting the start point mark as 1 instead of 0	Paper Total	5
	Plastic Sheet Total	7.5
	Thermoform Total	2.5
	Grand Total	5
Struggled in aligning the sheet to the mat	Paper Total	2.5
	Plastic Sheet Total	2.5
	Thermoform Total	2.5
	Grand Total	2.5

Table 5.6 APH Clip Ruler: Skill 2 Training O-Y Variation (%)

	O-Y Variation APH clip Ruler		
Using wrong side of the ruler	Plastic Sheet	O	0
		Y	25
Ruler Movement at start point (plotting or during measurement)	Plastic Sheet	O	5
		Y	15
Ruler movement or going crooked at Measuring and Plotting End point	Plastic Sheet	O	0
		Y	15
Students Counting the start point mark as 1 instead of 0	Plastic Sheet	O	0
		Y	15
Ruler Movement at start point (plotting or during measurement)	Paper	O	5
		Y	25
Careless counting mistakes/Measuring mistake	Paper	O	20

		Y	5
Errors in placing end point pins on marked TDs	Paper	O	25
		Y	50
Gap between Ruler and line	Thermoform	O	10
		Y	20

Table 6.6 APH Clip Ruler: Skill 2 Test Key Issues (%)

	0	APH Clip Ruler
Errors in placing end point pins on marked TDs	Paper Total	27.5
	Plastic Sheet Total	47.5
	Thermoform Total	2.5
	Grand Total	25.83333
Points/point markers/clip not accurately plotted against the marks	Paper Total	12.5
	Plastic Sheet Total	22.5
	Thermoform Total	22.5
	Grand Total	19.16667
Ruler Movement at start point (plotting or during measurement)	Paper Total	10
	Plastic Sheet Total	15
	Thermoform Total	20
	Grand Total	15
Careless counting mistakes/Measuring mistake	Paper Total	17.5
	Plastic Sheet Total	12.5
	Thermoform Total	15
	Grand Total	15
Student putting the start point at 0.5 mark leading to measurement errors later	Paper Total	17.5
	Plastic Sheet Total	12.5
	Thermoform Total	12.5
	Grand Total	14.16667
Using wrong side of the ruler	Paper Total	7.5
	Plastic	5

	Sheet Total	
	Thermoform Total	15
	Grand Total	9.166667
Ruler movement or going crooked at Measuring and Plotting End point	Paper Total	5
	Plastic Sheet Total	10
	Thermoform Total	2.5
	Grand Total	5.833333
Pin/clip little off and guessing measure	Paper Total	0
	Plastic Sheet Total	10
	Thermoform Total	5
	Grand Total	5
Right by Fluke	Paper Total	2.5
	Plastic Sheet Total	10
	Thermoform Total	2.5
	Grand Total	5
Clip movement at end point plotting/measuring	Paper Total	5
	Plastic Sheet Total	0
	Thermoform Total	7.5
	Grand Total	4.166667
Struggled in aligning the sheet to the mat	Paper Total	2.5
	Plastic Sheet Total	5
	Thermoform Total	0
	Grand Total	2.5

Table 6.8 APH Clip Ruler: Skill 3 Training Key Issues (%)

Skill 3 APH clip ruler Training		APH Wand-inside Protractor Total	APH Wand Protractor Total	Garg Protractor Total	RNIB Protractor Total	WT Protractor Total	Grand Total
Ruler/Protractor resting against wrong pins/Ruler Orientation causing drawing/measurement errors	APH Clip Ruler	0	0	0	7.964602	7.692308	24
Gap between pin and ruler/protractor whilst drawing/measurement causing errors	APH Clip Ruler	0	0	0	3.539823	8.547009	18.66667
Difficulty in straightening the ruler/protractor/point markers for baseline drawing	APH Clip Ruler	0	0	0	5.309735	6.837607	18.66667
Careless counting /Measuring Mistakes	APH Clip Ruler	0	0	0	0.884956	5.982906	10.66667

Table 6.9 APH Clip Ruler: Skill 3 Test Key Issues (%)

APH clip ruler Skill 3 test		APH Wand-inside Protractor Total	APH Wand Protractor Total	Garg Protractor Total	RNIB Protractor Total	WT Protractor Total	Grand Total
Difficulty in straightening the ruler/protractor/point markers for baseline drawing	APH Clip Ruler	0	0	0	10	7.5	26.25
Ruler/Protractor resting against wrong pins/Ruler Orientation causing drawing/measurement errors	APH Clip Ruler	0	0	0	8.333333	8.333333	25
Careless counting /Measuring Mistakes	APH Clip Ruler	0	0	0	4.166667	2.5	10

Table 6.10 APH Clip Ruler: Skill 5 Training Key Issues (%)

Skill 5 APH Clip ruler Test		APH Compass Total	Classmate Compass Total	Garg Compass Total	Worth Trust ruler as a compass Total	Grand Total
First leg at 0.5 mark causing measurement errors	APH Clip	0	2.5	0	0	10

	Ruler					
Random counting mistakes	APH Clip Ruler	0	3.75	0	0	15
Ruler movement whilst setting radius	APH Clip Ruler	0	3.75	0	0	15
Difficulty in setting the second leg to the accurate measurement (includes squirrel clip movement)	APH Clip Ruler	0	5.625	0	0	22 .5

Table 6.11 APH Clip Ruler: Skill 5 Test Key Issues (%)

Skill 5 APH Clip ruler Training		APH Compass Total	Classma te Compas s Total	Garg Compass Total	Worth Trust ruler as a compass Total	Grand Total
Ruler movement whilst setting radius	APH Clip Ruler	0	9.37 5	0	0	37.5

Table 6.7 Draftsman Ruler: Skill 1 Training Key Issues (%)

		Percentage
Training		
Points/point markers/clip not accurately plotted against the marks	Grand Total	62.5
Using wrong side of the ruler	Grand Total	35
Struggled in Immobilizing the ruler itself	Grand Total	25
Struggled with 0.5 Measurements	Grand Total	25
Struggled in pushing pins in the board/struggled in sliding point markers to position	Grand Total	20
Drawing beyond end point	Grand Total	17.5
Gap between pin and ruler whilst drawing causing errors	Grand Total	17.5
Difficulty in locating grooves	Grand Total	15
Stylus going away from the ruler whilst drawing	Grand Total	12.5
Struggled Drawing on the sheet	Grand Total	10
Drawing before end point	Grand Total	10
Board Turned to Draw	Grand Total	7.5
Students Counting the start point mark as 1 instead of 0	Grand Total	7.5
Ruler movement at connecting two points	Grand Total	7.5

Table 6.13 Draftsman Ruler: Skill 1 Training O-Y Variation (%)

Training		Draftsman Ruler
struggled in pushing pins in the board/struggled in sliding point markers to position	O	30
	Y	10
Using wrong side of the ruler	O	40
	Y	30

Struggled in Immobilizing the ruler itself	O	30
	Y	20
Struggled with 0.5 Measurements	O	20
	Y	30
Stylus going away from the ruler whilst drawing	O	5
	Y	20
Gap between pin and ruler whilst drawing causing errors	O	15
	Y	20
Difficulty in locating grooves	O	10
	Y	20

Table 6.14 Draftsman Ruler: Skill 1 Test Ruler Key Issues (%)

Points/point markers/clip not accurately plotted against the marks	Total	50
Drawing before end point	Total	27.5
Struggled in Immobilizing the paper	Total	25
Struggled in Immobilizing the ruler itself	Total	25
Careless counting mistakes/Measuring mistake	Total	25
Using wrong side of the ruler	Total	17.5
Struggled Drawing on the sheet	Total	12.5
Drawing beyond end point	Total	10
Struggled in aligning the sheet to the mat	Total	7.5
Board Turned to Draw	Total	7.5
Difficulty Understanding markings on the ruler	Total	7.5
Students Counting the start point mark as 1 instead of 0	Total	7.5
Stylus going away from the ruler whilst drawing	Total	7.5
Line being drawn under the ruler	Total	7.5

Table 6.15 Draftsman Ruler: Skill 1 Test O-Y Variation (%)

Struggled in aligning the sheet to the mat	Older	0
	Younger	15
Struggled in Immobilizing the paper	Older	15
	Younger	35
Stylus going away from the ruler whilst drawing	Older	15

Line being drawn under the ruler	Younger	0
	Older	0
	Younger	15

Table 6.16 Garg Ruler: Skill 1 Training Key Issues (%)

		Garg Ruler	
Struggled in pushing pins in the board/Struggled in sliding point markers to position	Grand Total	26	65
Line marker moved whilst drawing	Grand Total	16	40
Ruler movement or going crooked at Measuring and Plotting End point	Grand Total	15	37.5
Ruler Movement at plotting start point	Grand Total	12	30
Difficulty using Garg Stylus	Grand Total	12	30
Drawing beyond end point	Grand Total	10	25
Points/point markers/clip not accurately plotted against the marks	Grand Total	6	15
Difficulty in straightening the ruler at the start	Grand Total	5	12.5
Careless counting mistakes/Measuring mistake	Grand Total	4	10
Drawing before start point	Grand Total	4	10
Ruler Movement in Centralising the Ruler	Grand Total	3	7.5
Drawing after start point	Grand Total	3	7.5
Drawing before end point	Grand Total	3	7.5

Table 6.17 Garg Ruler: Skill 1 Training O-Y Variation (%)

Difficulty in straightening the ruler at the start	O	5
	Y	20
Ruler Movement in Centralising the Ruler	O	0
	Y	15

Careless counting mistakes/Measuring mistake	O	15
	Y	5
Drawing after start point	O	0
	Y	15

Table 6.18 Garg Ruler: Skill 1 Test Key Issues (%)

Struggled in pushing pins in the board/Struggled in sliding point markers to position	Total	52.5
Ruler movement or going crooked at Measuring and Plotting End point	Total	30
Difficulty using Garg Stylus	Total	30
Points/point markers/clip not accurately plotted against the marks	Total	25
Struggled Drawing on the sheet	Total	22.5
Ruler Movement at plotting start point	Total	17.5
Drawing beyond end point	Total	17.5
Careless counting mistakes/Measuring mistake	Total	17.5
Struggled in Immobilizing the paper	Total	10
Struggled in finding Free Space to draw	Total	10
Drawing before start point	Total	7.5
Drawing before end point	Total	7.5
Line marker moved whilst drawing	Total	7.5
Line creasing due to holding down line marker causing extend lines and confusion	Total	7.5
Struggled in Immobilizing the ruler itself	Total	0

Table 6.19 Garg Ruler: Skill 1 Test O-Y Variation (%)

Struggled in finding Free Space to draw	Older	15
	Younger	5
Ruler movement or going crooked at Measuring and Plotting End point	Older	40
	Younger	20

Table 6.20 Garg Ruler: Skill 2 Training Key Issues (%)

	0	0
Struggled in pushing pins in the board/Struggled in sliding point markers to position	Paper Total	57.5
	Plastic	0

	Sheet Total	
	Thermoform Total	0
	Grand Total	57.5
Errors in placing end point pins on marked TDs	Paper Total	55
	Plastic Sheet Total	0
	Thermoform Total	0
	Grand Total	55
Points/point markers/clip not accurately plotted against the marks	Paper Total	22.5
	Plastic Sheet Total	0
	Thermoform Total	0
	Grand Total	22.5
Difficult in replotting the correct end points once pin mark was made in an inaccurate spot	Paper Total	10
	Plastic Sheet Total	0
	Thermoform Total	0
	Grand Total	10
TDs not distinct enough	Paper Total	10
	Plastic Sheet Total	0
	Thermoform Total	0

	Grand Total	10
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Table 6.21 Garg Ruler: Skill 2 Training O-Y Variation (%)

	O-Y Variation Garg		
Difficult in replotting the correct end points once pin mark was made in an inaccurate spot	Paper	O	15
	0	Y	5
TDs not distinct enough	Paper	O	5
	0	Y	15

Table 6.22 Garg Ruler: Skill 2 Test Key Issues (%)

	0	
Errors in placing end point pins on marked TDs	Paper Total	55
	Plastic Sheet Total	0
	Thermofo rm Total	0
	Grand Total	55
Struggled in pushing pins in the board/Struggled in sliding point markers to position	Paper Total	32.5
	Plastic Sheet Total	0

	Thermofo rm Total	0
	Grand Total	32.5
Points/point markers/clip not accurately plotted against the marks	Paper Total	17.5
	Plastic Sheet Total	0
	Thermofo rm Total	0
	Grand Total	17.5
Difficult in replotting the correct end points once pin mark was made in an inaccurate spot	Paper Total	12.5
	Plastic Sheet Total	0
	Thermofo rm Total	0
	Grand Total	12.5

Table 6.23 RNIB Ruler: Skill 1 Training Key Issues (%)

		RNIB Ruler	
Points/point markers/clip not accurately plotted against the marks	Grand Total	17	42.5
Ruler movement or going crooked at Measuring and Plotting End point	Grand Total	14	35
Using wrong side of the ruler	Grand Total	12	30
Ruler Movement at plotting start point	Grand Total	11	27.5
Drawing before end point	Grand Total	9	22.5
Ruler movement at connecting two points	Grand Total	7	17.5
Careless counting mistakes/Measuring mistake	Grand Total	5	12.5

Stylus going away from the ruler whilst drawing	Grand Total	5	12.5
Drawing beyond end point	Grand Total	5	12.5
Struggled Drawing on the sheet	Grand Total	4	10
Board Turned to Draw	Grand Total	4	10
Difficulty in straightening the ruler at the start	Grand Total	4	10
Struggled with 0.5 Measurements	Grand Total	4	10
Students Counting the start point mark as 1 instead of 0	Grand Total	4	10

Table 6.24 RNIB Ruler: Skill 1 Training O-Y Variation (%)

Struggled Drawing on the sheet	O	3	15
	Y	1	5
Struggled with 0.5 Measurements	O	0	0
	Y	4	20
Careless counting mistakes/Measuring mistake	O	0	0
	Y	5	25
Students Counting the start point mark as 1 instead of 0	O	1	5
	Y	3	15

Table 6.25 RNIB Ruler: Skill 1 Test Key Issues (%)

		RNIB Ruler
Stylus going away from the ruler whilst drawing	Total	47.5
Ruler movement at connecting two points	Total	42.5
Ruler Movement in Centralising the Ruler	Total	30
Difficulty Understanding markings on the ruler	Total	27.5
Drawing beyond end point	Total	15
Drawing before end point	Total	12.5
Ruler Movement at plotting start point	Total	12.5
Using wrong side of the ruler	Total	10
Ruler movement or going crooked at Measuring and Plotting End point	Total	10

Careless counting mistakes/Measuring mistake	Total	10
Gap between pin and ruler whilst drawing causing errors	Total	10
Struggled in aligning the sheet to the mat	Total	10
Student putting the start point at 0.5 mark leading to measurement errors later	Total	10
Points/point markers/clip not accurately plotted against the marks	Total	7.5
Struggled Drawing on the sheet	Total	7.5
Struggled in sliding the sheet and the mat in the board	Total	7.5

Table 6.26 RNIB Ruler: Skill 1 Test O-Y Variation (%)

Struggled in sliding the sheet and the mat in the board	Older	5
	Younger	15
Careless counting mistakes/Measuring mistake	Older	5
	Younger	20
Ruler movement at connecting two points	Older	20
	Younger	10
Stylus going away from the ruler whilst drawing	Older	0
	Younger	20
Drawing beyond end point	Older	15
	Younger	5
Gap between pin and ruler whilst drawing causing errors	Older	15
	Younger	5

Table 6.27 RNIB Ruler: Skill 2 Training Key Issues (%)

	0	
Errors in placing end point pins on marked TDs	Paper Total	45
	Plastic Sheet Total	55
	Thermoform Total	0
	Grand Total	33.333 33
Points/point markers/clip not accurately plotted against the marks	Paper Total	20
	Plastic Sheet Total	17.5
	Thermoform Total	10
	Grand Total	15.833 33
Careless counting mistakes/Measuring mistake	Paper Total	5
	Plastic Sheet Total	10
	Thermoform Total	27.5
	Grand Total	14.166 67
Using wrong side of the ruler	Paper Total	7.5
	Plastic Sheet Total	5
	Thermoform Total	12.5
	Grand Total	8.3333 33
Ruler Movement at start point (plotting or during measurement)	Paper Total	0
	Plastic Sheet Total	7.5
	Thermoform Total	12.5
	Grand Total	6.6666 67
Student putting the start point at 0.5 mark leading to measurement errors later	Paper Total	0
	Plastic Sheet Total	5

	Thermoform Total	15
	Grand Total	6.6666 67
Ruler movement or going crooked at Measuring and Plotting End point	Paper Total	5
	Plastic Sheet Total	5
	Thermoform Total	5
	Grand Total	5
Students Counting the start point mark as 1 instead of 0	Paper Total	0
	Plastic Sheet Total	7.5
	Thermoform Total	5
	Grand Total	4.1666 67
Difficulty Understanding markings on the ruler	Paper Total	5
	Plastic Sheet Total	5
	Thermoform Total	0
	Grand Total	3.3333 33

Table 6.28 RNIB Ruler: Skill 2 Training O-Y Variation (%)

		O-Y Variati on for RNIB	
Using wrong side of the ruler	Thermoform	O	20
		Y	5
Careless counting mistakes/Measuring mistake	Plastic Sheet	O	20
		Y	0

Table 6.29 RNIB Ruler: Skill 2 Test Key Issues (%)

	0	
Errors in placing end point pins on marked TDs	Paper Total	40
	Plastic Sheet Total	52.5
	Thermoform Total	5
	Grand Total	32.5
Points/point markers/clip not accurately plotted against the marks	Paper Total	17.5
	Plastic Sheet Total	30
	Thermoform Total	7.5
	Grand Total	18.3333
Using wrong side of the ruler	Paper Total	7.5
	Plastic Sheet Total	7.5
	Thermoform Total	32.5
	Grand Total	15.8333
Careless counting mistakes/Measuring mistake	Paper Total	10
	Plastic Sheet Total	15
	Thermoform Total	10
	Grand Total	11.6667
Student putting the start point at 0.5 mark leading to measurement errors later	Paper Total	7.5
	Plastic Sheet Total	10
	Thermoform Total	5
	Grand Total	7.5
Pin/clip little off and guessing measure	Paper Total	5
	Plastic Sheet Total	12.5

	Thermoform Total	0
	Grand Total	5.833333
Ruler Movement at start point (plotting or during measurement)	Paper Total	0
	Plastic Sheet Total	2.5
	Thermoform Total	7.5
	Grand Total	3.333333
Right by Fluke	Paper Total	2.5
	Plastic Sheet Total	5
	Thermoform Total	2.5
	Grand Total	3.333333

Table 6.30 RNIB Ruler: Skill 3 Training Key Issues (%)

Skill 3: RNIB Ruler Key Issues Training		APH Wand-inside Protector Total	APH Wand Protractor Total	Garg Protractor Total	RNIB Protractor Total	WT Protractor Total	Grand Total
Did not draw till end point	RNIB Ruler	0	0	0	6.19469	6.837607	18.98734
Gap between pin and ruler/protractor whilst	RNIB Ruler	0	0	0	7.079646	7.692308	21.51899

drawing/measure ment causing errors							
Ruler/Protractor resting against wrong pins/Ruler Orientation causing drawing/measure ment errors	RNIB Ruler	0	0	0	8.849 558	6.8376 07	22.78 481
Using wrong side of the ruler	RNIB Ruler	0	0	0	9.734 513	10.256 41	29.11 392

Table 6.31 RNIB Ruler: Skill 3 Test Key Issues (%)

Skill 3: RNIB Ruler Key Issues Test		APH Wand- inside Protract or Total	APH Wand Protractor Total	Garg Protract or Total	RNIB Protract or Total	WT Protractor Total	Grand Total
Difficulty in straightening the ruler/protractor/point markers for baseline drawing	RNIB Ruler	0	0	0	7.5	5	18.7 5
Did not draw till end point	RNIB Ruler	0	0	0	7.5	5.8333 33	20
Ruler/Protractor resting against wrong pins/Ruler Orientation causing drawing/measure ment errors	RNIB Ruler	0	0	0	3.33 3333	5	12.5
Using wrong side of the ruler	RNIB Ruler	0	0	0	6.66 6667	5	17.5

Table 6.32 RNIB Ruler: Skill 5 Training Key Issues (%)

Skill 5: RNIB Ruler Key Issues Training		APH Compa ss Total	Classma te Compas s Total	Garg Compa ss Total	Worth Trust ruler as a compa ss Total	Gran d Total
First Leg of compass coming off whilst setting radius	RNI B Rule	0	3.75	0	0	15

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Table 6.33 RNIB Ruler: Skill 5 Test Key Issues (%)

Skill 5: RNIB Ruler Key Issues Test		APH Compass Total	Classmate Compass Total	Garg Compass Total	Worth Trust ruler as a compass Total	Grand Total
Random counting mistakes	RNIB Ruler	0	3.75	0	0	15
Ruler movement whilst setting radius	RNIB Ruler	0	3.125	0	0	12.5
Difficulty in setting the second leg to the accurate measurement (includes quirel clip movement)	RNIB Ruler	0	4.375	0	0	17.5

Table 6.34 Squirrel Ruler: Skill 1 Training Key Issues (%)

		Squirrel Ruler	
Clip movement at drawings	Grand Total	12	30
Braille Reading Difficulty due to Braille Quality	Grand Total	11	27.5
Ruler movement at connecting two points	Grand Total	11	27.5
Clip movement at end point plotting	Grand Total	10	25
Difficulty in understanding the 16 divided concept for inches	Grand Total	10	25
Board Turned to Draw	Grand	9	22.5

	Total		
Braille Reading Skill Limitations	Grand Total	7	17.5
Ruler movement or going crooked at Measuring and Plotting End point	Grand Total	5	12.5
Difficulty in straightening the ruler at the start	Grand Total	4	10
Stylus going away from the ruler whilst drawing	Grand Total	4	10
Ruler Movement in Centralising the Ruler	Grand Total	3	7.5
Struggled with 0.5 Measurements	Grand Total	3	7.5

Table 6.35 Squirrel Ruler: Skill 1 Training O-Y Variation (%)

Board Turned to Draw	O	15
	Y	30
Braille Reading Skill Limitations	O	10
	Y	25
Difficulty in straightening the ruler at the start	O	5
	Y	15
Ruler movement at connecting two points	O	15
	Y	40

Table 6.8 Squirrel Ruler: Skill 1 Test Key Issues (%)

	Total
Ruler movement at connecting two points	30
Clip movement at drawings	22.5
Braille Reading Skill Limitations	20
Ruler Movement in Centralising the Ruler	20
Difficulty in understanding the 16 divided concept for inches	17.5
Ruler Movement at plotting start point	12.5
Ruler movement or going crooked at Measuring and Plotting End point	12.5
Drawing before end point	12.5
Difficulty in straightening the ruler at the start	10

Careless counting mistakes/Measuring mistake	10
Drawing beyond end point	10
Struggled Drawing on the sheet	7.5
Struggled with 0.5 Measurements	7.5
Clip movement at end point plotting	7.5
Points/point markers/clip not accurately plotted against the marks	7.5
Drawing after start point	7.5

Table 6.37 Squirrel Ruler: Skill 1 Test O-Y Variation (%)

Difficulty in straightening the ruler at the start	Older	15
	Younger	5
Ruler Movement at plotting start point	Older	5
	Younger	20
Ruler movement or going crooked at Measuring and Plotting End point	Older	5
	Younger	20
Careless counting mistakes/Measuring mistake	Older	0
	Younger	20
Clip movement at end point plotting	Older	0
	Younger	15
Drawing before end point	Older	5
	Younger	20
Clip movement at drawings	Older	10
	Younger	35
Difficulty in understanding the 16 divided concept for inches	Older	10
	Younger	25

Table 6.38 Squirrel Ruler: Skill 2 Training Key Issues (%)

	0	Squirrel Ruler
Braille Reading Skill Limitations	Paper Total	15
	Plastic Sheet Total	37.5
	Thermoform Total	27.5

	Grand Total	26.666 67
Errors in placing end point pins on marked TDs	Paper Total	20
	Plastic Sheet Total	40
	Thermoform Total	2.5
	Grand Total	20.833 33
Struggled with 0.5 Measurements	Paper Total	5
	Plastic Sheet Total	12.5
	Thermoform Total	20
	Grand Total	12.5
Points/point markers/clip not accurately plotted against the marks	Paper Total	7.5
	Plastic Sheet Total	17.5
	Thermoform Total	10
	Grand Total	11.666 67
Difficulty in understanding the 16 divided concept for inches	Paper Total	7.5
	Plastic Sheet Total	10
	Thermoform Total	12.5
	Grand Total	10
Gap between Ruler and line	Paper Total	5
	Plastic Sheet Total	5
	Thermoform Total	17.5
	Grand Total	9.1666 67
Pin/clip little off and guessing measure	Paper Total	15
	Plastic Sheet Total	7.5
	Thermoform Total	2.5

	Grand Total	8.3333 33
Clip movement at end point plotting/measuring	Paper Total	2.5
	Plastic Sheet Total	2.5
	Thermoform Total	12.5
	Grand Total	5.8333 33

Table 6.39 Squirrel Ruler: Skill 2 Training O-Y Variation (%)

O-Y Variation Squirrel Ruler	0		
Braille Reading Skill Limitations	Paper	O	10
		Y	20
Difficulty in understanding the 16 divided concept for inches	Plastic Sheet	O	5
		Y	15
Gap between Ruler and line	Thermoform	O	10
		Y	25

Table 6.40 Squirrel Ruler: Skill 2 Test Key Issues (%)

Errors in placing end point pins on marked TDs	Paper Total	30
	Plastic Sheet Total	42.5
	Thermoform Total	5
	Grand Total	25.8333 3
Braille Reading Skill Limitations	Paper Total	12.5
	Plastic Sheet Total	15
	Thermoform Total	20
	Grand Total	15.8333 3
Points/point markers/clip not accurately plotted against the marks	Paper Total	22.5
	Plastic Sheet Total	12.5
	Thermoform Total	7.5
	Grand Total	14.1666 7
Gap between Ruler and line	Paper Total	2.5
	Plastic Sheet Total	7.5
	Thermoform Total	7.5
	Grand Total	5.83333 3
Careless counting mistakes/Measuring mistake	Paper Total	7.5
	Plastic Sheet Total	2.5
	Thermoform Total	5
	Grand Total	5
Pin/clip little off and guessing measure	Paper Total	2.5
	Plastic Sheet Total	10
	Thermoform Total	0

	Grand Total	4.166667
Right by Fluke	Paper Total	2.5
	Plastic Sheet Total	7.5
	Thermoform Total	2.5
	Grand Total	4.166667
Ruler Movement at start point (plotting or during measurement)	Paper Total	2.5
	Plastic Sheet Total	0
	Thermoform Total	7.5
	Grand Total	3.333333
Clip movement at end point plotting/measuring	Paper Total	2.5
	Plastic Sheet Total	5
	Thermoform Total	2.5
	Grand Total	3.333333

Table 6.41 Squirrel Ruler: Skill 5 Training Key issues (%)

		APH Comp ass Total	Classm ate Compa ss Total	Garg Comp ass Total	Worth Trust ruler as a comp ass Total	Gra nd Tota l
Ruler movement whilst setting radius	Squir rel Ruler	0	3.125	0	0	12.5
first Leg of compass coming off whilst setting radius	Squir rel Ruler	0	6.25	0	0	25
Braille Reading Skill	Squir	0	5	0	0	20

Limitations	rel Ruler					
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Table 6.42 Squirrel Ruler: Skill 5 Test Key Issues (%)

		APH Comp ass Total	Classm ate Compa ss Total	Garg Comp ass Total	Worth Trust ruler as a compass Total	Gr an d Tot al
First Leg of compass coming off whilst setting radius	Squ irrel Rul er	0	2.5	0	0	10
Braille Reading Skill Limitations	Squ irrel Rul er	0	3.125	0	0	12.5
Difficulty in setting the second leg to the accurate measurement (includes quirrel clip movement)	Squ irrel Rul er	0	10	0	0	40

Table 6.43 Worth Trust Ruler: Skill 1 Training Key Issues (%)

		Worth Trust Ruler	
Points/point markers/clip not accurately plotted against the marks	Grand Total	17	42.5
Struggled in Immobilizing the ruler itself	Grand Total	12	30
Ruler movement at connecting two points	Grand Total	12	30
Stylus going away from the ruler whilst drawing	Grand Total	12	30
Ruler movement or going crooked at Measuring and Plotting End point	Grand Total	8	20

Drawing beyond end point	Grand Total	7	17.5
Drawing before end point	Grand Total	7	17.5
Struggled Drawing on the sheet	Grand Total	6	15
Ruler Movement at plotting start point	Grand Total	6	15
Students Counting the start point mark as 1 instead of 0	Grand Total	6	15
Difficulty Understanding markings on the ruler	Grand Total	4	10
Difficulty in straightening the ruler at the start	Grand Total	4	10
Careless counting mistakes/Measuring mistake	Grand Total	4	10
Board Turned to Draw	Grand Total	3	7.5
Drawing after start point	Grand Total	3	7.5
Line being drawn under the ruler	Grand Total	3	7.5

Table 6.44 Worth Trust Ruler: Skill 1 Training O-Y Variation (%)

Struggled Drawing on the sheet	O	10
	Y	20
Difficulty Understanding markings on the ruler	O	5
	Y	15
Difficulty in straightening the ruler at the start	O	0
	Y	20
Ruler Movement at plotting start point	O	25
	Y	5
Ruler movement or going crooked at Measuring and Plotting End point	O	30
	Y	10
Careless counting mistakes/Measuring mistake	O	0
	Y	20
Stylus going away from the ruler whilst drawing	O	20
	Y	40
Drawing beyond end point	O	10
	Y	25

Drawing after start point	O	0
	Y	15

Table 6.45 Worth Trust Ruler: Skill 1 Test Key Issues (%)

Points/point markers/clip not accurately plotted against the marks	Total	22.5
Drawing before end point	Total	22.5
Struggled in Immobilizing the ruler itself	Total	17.5
Ruler movement at connecting two points	Total	17.5
Drawing beyond end point	Total	17.5
Drawing after start point	Total	15
Struggled Drawing on the sheet	Total	12.5
Careless counting mistakes/Measuring mistake	Total	12.5
Drawing before start point	Total	12.5
Board Turned to Draw	Total	10
Ruler Movement at plotting start point	Total	10
Ruler movement or going crooked at Measuring and Plotting End point	Total	10
Line being drawn under the ruler	Total	7.5
Students putting the start point or end point on the mount	Total	0

Table 6.46 Worth Trust Ruler: Skill 1 Test O-Y Variation (%)

Struggled Drawing on the sheet	Older	5
	Younger	20
Ruler Movement at plotting start point	Older	5
	Younger	15
Ruler movement or going crooked at Measuring and Plotting End point	Older	5
	Younger	15
Drawing beyond end point	Older	10
	Younger	25
Drawing before start point	Older	20
	Younger	5
Drawing before end point	Older	15
	Younger	30

Table 6.47 Worth Trust Ruler: Skill 2 Training Key Issues (%)

	0	Worth
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		Trust Ruler
Errors in placing end point pins on marked TDs	Paper Total	25
	Plastic Sheet Total	47.5
	Thermofo rm Total	2.5
	Grand Total	25
Ruler Movement at start point (plotting or during measurement)	Paper Total	10
	Plastic Sheet Total	5
	Thermofo rm Total	25
	Grand Total	13.333 33
Points/point markers/clip not accurately plotted against the marks	Paper Total	10
	Plastic Sheet Total	12.5
	Thermofo rm Total	10
	Grand Total	10.833 33
Careless counting mistakes/Measuring mistake	Paper Total	5
	Plastic Sheet Total	7.5
	Thermofo rm Total	17.5
	Grand Total	10
Students Counting the start point mark as 1 instead of 10	Paper Total	2.5

	Plastic Sheet Total	10
	Thermofo rm Total	10
	Grand Total	7.5
Difficult in replotting the correct end points once pin mark was made in an inaccurate spot	Paper Total	7.5
	Plastic Sheet Total	5
	Thermofo rm Total	0
	Grand Total	4.1666 67

Table 6.48 Worth Trust Ruler: Skill 2 Training O-Y Variation (%)

Worth trust Ruler O-Y Variation			
Ruler Movement at start point (plotting or during measurement)	Thermoform	O	15
	0	Y	35
Careless counting mistakes/Measuring mistake	Plastic Sheet	O	0
	0	Y	15
Students Counting the start point mark as 1 instead of 0	Plastic Sheet	O	5
	0	Y	15
	Thermoform	O	15
	0	Y	5

Table 6.49 Worth Trust Ruler: Skill 2 Test Key Issues (%)

Errors in placing end point pins on marked TDs	Paper Total	45
	Plastic Sheet Total	30
	Thermofo rm Total	7.5
	Grand Total	27.5
Points/point markers/clip not accurately plotted against the marks	Paper Total	12.5
	Plastic	10

	Sheet Total	
	Thermofo rm Total	10
	Grand Total	10.8333
Student putting the start point at 0.5 mark leading to measurement errors later	Paper Total	10
	Plastic Sheet Total	10
	Thermofo rm Total	7.5
	Grand Total	9.166667
Careless counting mistakes/Measuring mistake	Paper Total	7.5
	Plastic Sheet Total	10
	Thermofo rm Total	10
	Grand Total	9.166667
Ruler Movement at start point (plotting or during measurement)	Paper Total	5
	Plastic Sheet Total	5
	Thermofo rm Total	10
	Grand Total	6.666667
Ruler movement or going crooked at Measuring and Plotting End point	Paper Total	10
	Plastic Sheet Total	5
	Thermofo rm Total	5

	Grand Total	6.666667
Right by Fluke	Paper Total	7.5
	Plastic Sheet Total	7.5
	Thermofom Total	2.5
	Grand Total	5.833333
Pin/clip little off and guessing measure	Paper Total	5
	Plastic Sheet Total	5
	Thermofom Total	5
	Grand Total	5

Table 6.50 Worth Trust Ruler: Skill 3 Training Key Issues (%)

Skill 3: WT Ruler Key Issues Training		APH Wand-inside Protractor Total	APH Wand Protractor Total	Garg Protractor Total	RNIB Protractor Total	WT Protractor Total	Grand Total
Difficulty in straightening the ruler/protractor/point markers for baseline drawing	WT Ruler	0	0	0	13.27434	11.96581	38.15789
Protractor/ Ruler movement whilst drawing baseline	WT Ruler	0	0	0	3.539823	3.418803	10.52632
Protractor/Ruler movement whilst	WT Ruler	0	0	0	5.309735	4.273504	14.47

drawing second arm							368
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Table 6.51 Worth Trust Ruler: Skill 3 Test Key Issues (%)

Skill 3: WT Ruler Key Issues Test		APH Wand-inside Protractor Total	APH Wand Protractor Total	Garg Protractor Total	RNIB Protractor Total	WT Protractor Total	Grand Total
Difficulty in straightening the ruler/protractor/point markers for baseline drawing	WT Ruler	0	0	0	10.83333	12.5	35
Protractor/Ruler movement whilst drawing second arm	WT Ruler	0	0	0	2.5	4.166667	10
Stylus not touching protractor/wand/ruler when drawing	WT Ruler	0	0	0	4.166667	4.166667	12.5

Worth Trust Ruler: Skill 5 training no key issues**Table 6.52 Worth Trust Ruler: Skill 5 Test Key Issues (%)**

Skill 5: WT Ruler Key Issues Test		APH Compass Total	Classmate Compass Total	Garg Compass Total	Worth Trust ruler as a compass Total	Grand Total
First leg at 0.5 mark causing measurement errors	Worth Trust Ruler	0	3.75	0	0	15
Difficulty in setting the second leg to the accurate measurement (includes squirrel clip movement)	Worth Trust Ruler	0	5	0	0	20

Table 9. Ruler Across Skill Questionnaire Objective Data (%)

Selected for game (Ruler)			
Tools	Skill 1	Skill 2	Skill 3
APH Clip Ruler	2.5	10	5
Draftsman Ruler	20	NA	NA
Garg Ruler / Line Marker	20	12.5	5
RNIB Ruler	15	22.5	17.5
Squirrel Ruler	22.5	42.5	NA
Worth Trust Ruler	20	12.5	17.5
None	NA	NA	55

Table 6.54 .Ruler Cross Skills Questionnaire Selected for Game (%)

	Easiest Ruler				Most Liked				Most Difficult		
Tools	Skill 1	Skill 2	Skill 3	Skill 5	Skill 1	Skill 2	Skill 3	Skill 5	Skill 1	Skill 2	Skill 3
APH Clip Ruler	7.317073	4.761905	22.5	16.21622	6.666667	7.142857	25	2.777778	22.5	22.5	36.537
Draftsman Ruler	14.63415	NA	NA	NA	22.22222	NA	NA	NA	27.5	NA	NA
Garg Ruler / Line Marker	4.878049	9.52381	NA	NA	15.55556	16.66667	NA	NA	22.5	20	NA
RNIB Ruler	17.07317	26.19048	45	27.02703	4.444444	16.66667	40	22.22222	7.5	15	19.22
Squirrel Ruler	36.58537	47.61905	0	24.32432	28.88889	52.38095	0	27.77778	10	25	0
Worth Trust Ruler	19.5122	11.90476	30	32.43243	22.22222	7.142857	35	47.22222	10	15	36.537

Table 6.55 .Test Stage Results for Skill 1: Drawing a Line Segment (%)

Test Skill 1: Drawing a Line Segment		
Tools	Right	Wrong
APH Clip Ruler	10	90
Draftsman Ruler	42.5	57.5
Garg Ruler	52.5	47.5
RNIB Ruler	22.5	77.5
Squirrel Ruler	45	55
Worth Trust Ruler	37.5	62.5

Table 6.56 Test Stage Results for Skill 2: Measuring a Line Segment (%)

Test Skill 2: Measuring a Line Segment						
	Paper		Plastic Sheet		Thermoform	
	Right	Wrong	Right	Wrong	Right	Wrong
APH Clip Ruler	48.78049	51.21951	50	50	70	30
Garg Ruler	55	45	NA	NA	NA	NA
RNIB Ruler	60	40	62.5	37.5	80	20
Squirrel Ruler	52.5	47.5	60	40	72.5	27.5
Worth Trust Ruler	58.97436	41.02564	74.35897	28.20513	79.48718	23.07692

Table 6.57 Test Stage Results for Skill 3: Constructing an Angle (%)

Test Skill 3: Constructing an Angle										
	APH Wand-inside Protractor		APH Wand Protractor		Garg Protractor		RNIB Protractor		WT Prot	
	Right	Wrong	Right	Wrong	Right	Wrong	Right	Wrong	Right	Wrong
APH Clip Ruler	0	0	0	0	0	0	32.5	67.5	37.5	62.5
None	25	75	32.5	67.5	50	50	0	0	0	100
RNIB Ruler	0	0	0	0	0	0	47.5	52.5	40	60
WT Ruler	0	0	0	0	0	0	55	45	37.5	62.5

Table 6.58 Test Stage Results for Skill 5: Constructing a Circle (%)

Test Skill 5: Constructing an Angle								
	APH Compass		Classmate Compass		Garg Compass		Worth Trust ruler as a compass	
	Right	Wrong	Right	Wrong	Right	Wrong	Right	Wrong
APH Clip Ruler	0	0	10	90	0	0	0	0
NA	42.5	57.5	0	0	90	10	65	35
RNIB Ruler	0	0	22.5	77.5	0	0	0	0
Squirrel Ruler	0	0	25	75	0	0	0	0
Worth Trust Ruler	0	0	27.5	72.5	0	0	0	0

ANNEXURE L DATA TABLES FOR CHAPTER 7**Table 7.1: APH Wand-inside Protractor: Skill 3 Training Key Issues (%)**

		APH Wand-inside Protractor Total
Stylus going underneath the protractor/wand/ruler whilst drawing	APH Clip Ruler	0
	None	43.58974359
	RNIB Ruler	0
	WT Ruler	0
	Total	43.58974359
Wand movement causing drawing/measurement errors	APH Clip Ruler	0
	None	28.20512821
	RNIB Ruler	0
	WT	0

	Ruler	
	Total	28.20512821
Difficulty in straightening the ruler/protractor/point markers for baseline drawing	APH Clip Ruler	0
	None	20.51282051
	RNIB Ruler	0
	WT Ruler	0
	Total	20.51282051
Stylus not touching protractor/wand/ruler when drawing	APH Clip Ruler	0
	None	20.51282051
	RNIB Ruler	0
	WT Ruler	0
	Total	20.51282051
Found 3 pin method for APH Wand-inside protractor confusing	APH Clip Ruler	0
	None	20.51282051
	RNIB Ruler	0
	WT Ruler	0
	Total	20.51282051
Errors/Difficulty in placing point pins on marked TDs/drawings (vertex/on arms)	APH Clip Ruler	0
	None	17.94871795
	RNIB Ruler	0
	WT Ruler	0
	Total	17.94871795
Putting pins off the immobilization grooves of protractor making the protractor move	APH Clip	0

	Ruler	
	None	15.38461538
	RNIB Ruler	0
	WT Ruler	0
	Total	15.38461538
Protractor/ Ruler movement whilst drawing baseline	APH Clip Ruler	0
	None	12.82051282
	RNIB Ruler	0
	WT Ruler	0
	Total	12.82051282
Protractor/Ruler movement whilst drawing second arm	APH Clip Ruler	0
	None	12.82051282
	RNIB Ruler	0
	WT Ruler	0
	Total	12.82051282
Did not draw till end point	APH Clip Ruler	0
	None	12.82051282
	RNIB Ruler	0
	WT Ruler	0
	Total	12.82051282
Difficulty in placing the measurement point exactly at the groove/mark	APH Clip Ruler	0
	None	12.82051282
	RNIB Ruler	0

	WT Ruler	0
	Total	12.82051282
Struggled Drawing on the sheet	APH Clip Ruler	0
	None	10.25641026
	RNIB Ruler	0
	WT Ruler	0
	Total	10.25641026
Errors in using the short cut for measurement	APH Clip Ruler	0
	None	10.25641026
	RNIB Ruler	0
	WT Ruler	0
	Total	10.25641026
Errors in measurement due to non-familiarity with 45-90 system	APH Clip Ruler	0
	None	10.25641026
	RNIB Ruler	0
	WT Ruler	0
	Total	10.25641026
Struggled in Placing the Protractor with right orientation	APH Clip Ruler	0
	None	7.692307692
	RNIB Ruler	0
	WT Ruler	0
	Total	7.692307692
Struggled in reading measurement/Difficulty in	APH	0

understanding markings	Clip Ruler	
	None	7.692307692
	RNIB Ruler	0
	WT Ruler	0
	Total	7.692307692
Removing wrong pins whilst removing the protractor for drawing	APH Clip Ruler	0
	None	5.128205128
	RNIB Ruler	0
	WT Ruler	0
	Total	5.128205128
Ruler/Protractor resting against wrong pins/Ruler Orientation causing drawing/measurement errors	APH Clip Ruler	0
	None	5.128205128
	RNIB Ruler	0
	WT Ruler	0
	Total	5.128205128

Table 7.2 APH Wand-inside Protractor: Skill 3 Training O-Y Variation (%)

O/Y Variation APH Wand-inside Protractor		O
Struggled in reading measurement/Difficulty in understanding markings	None	0
Stylus not touching protractor/wand/ruler when drawing	None	5.263158
Stylus going underneath the protractor/wand/ruler whilst drawing	None	57.89474
Difficulty in placing the measurement point exactly at the groove/mark	None	5.263158

Table 7.3 APH Wand-inside Protractor: Skill 3 Test Key Issues (%)

		APH Wand-inside Protract or Total
Difficulty in placing the measurement point exactly at the groove/mark	APH Clip Ruler	0
	None	37.5
	RNIB Ruler	0
	WT Ruler	0
	Total	37.5
Found 3 pin method for APH Wand-inside prot confusing	APH Clip Ruler	0
	None	30
	RNIB Ruler	0
	WT Ruler	0
	Total	30
Stylus going underneath the protractor/wand/ruler whilst drawing	APH Clip Ruler	0
	None	25
	RNIB Ruler	0
	WT Ruler	0
	Total	25
Did not draw till end point	APH Clip Ruler	0
	None	25
	RNIB Ruler	0
	WT Ruler	0

	Total	25
Cannot be Assessed	APH Clip Ruler	0
	None	20
	RNIB Ruler	0
	WT Ruler	0
	Total	20
Stylus not touching protractor/wand/ruler when drawing	APH Clip Ruler	0
	None	17.5
	RNIB Ruler	0
	WT Ruler	0
	Total	17.5
Wand movement causing drawing/measurement errors	APH Clip Ruler	0
	None	17.5
	RNIB Ruler	0
	WT Ruler	0
	Total	17.5
Protractor/Ruler movement whilst drawing second arm	APH Clip Ruler	0
	None	15
	RNIB Ruler	0
	WT Ruler	0
	Total	15
Struggled in Placing the Protractor with right orientation	APH Clip Ruler	0

	None	12.5
	RNIB Ruler	0
	WT Ruler	0
	Total	12.5
Difficulty in straightening the ruler/protractor/point markers for baseline drawing	APH Clip Ruler	0
	None	12.5
	RNIB Ruler	0
	WT Ruler	0
	Total	12.5
Errors/Difficulty in placing point pins on marked TDs/drawings (vertex/on arms)	APH Clip Ruler	0
	None	12.5
	RNIB Ruler	0
	WT Ruler	0
	Total	12.5
Careless counting /Measuring Mistakes	APH Clip Ruler	0
	None	12.5
	RNIB Ruler	0
	WT Ruler	0
	Total	12.5
Ruler/Protractor resting against wrong pins/Ruler Orientation causing drawing/measurement errors	APH Clip Ruler	0
	None	12.5
	RNIB Ruler	0
	WT	0

	Ruler	
	Total	12.5
Right by Fluke	APH Clip Ruler	0
	None	10
	RNIB Ruler	0
	WT Ruler	0
	Total	10
Protractor/ Ruler movement whilst drawing baseline	APH Clip Ruler	0
	None	7.5
	RNIB Ruler	0
	WT Ruler	0
	Total	7.5
Struggled in reading measurement/Difficulty in understanding markings	APH Clip Ruler	0
	None	7.5
	RNIB Ruler	0
	WT Ruler	0
	Total	7.5
Gap between pin and ruler/protractor whilst drawing/measurement causing errors	APH Clip Ruler	0
	None	7.5
	RNIB Ruler	0
	WT Ruler	0
	Total	7.5

Table 7.4 APH Wand-inside Protractor: Skill 3 Test O-Y Variation (%)

	Older	Younger
Struggled in Placing the Protractor with right orientation	5	20
Protractor/Ruler movement whilst drawing second arm	20	10
Stylus not touching protractor/wand/ruler when drawing	10	25
Errors/Difficulty in placing point pins on marked TDs/drawings (vertex/on arms)	5	20
Did not draw till end point	35	15
Gap between pin and ruler/protractor whilst drawing/measurement causing errors	0	15
Cannot be Assessed	10	30

Table 7.5 APH Wand Protractor: Skill 3 Training Key Issues (%)

		APH Wand Protractor Total
Stylus going underneath the protractor/wand/ruler whilst drawing	APH Clip Ruler	0
	None	40
	RNIB Ruler	0
	WT Ruler	0
	Total	40
Difficulty in straightening the ruler/protractor/point markers for baseline drawing	APH Clip Ruler	0
	None	37.5
	RNIB	0

	Ruler	
	WT Ruler	0
	Total	37.5
Protractor/Ruler movement whilst drawing second arm	APH Clip Ruler	0
	None	32.5
	RNIB Ruler	0
	WT Ruler	0
	Total	32.5
Protractor/ Ruler movement whilst drawing baseline	APH Clip Ruler	0
	None	20
	RNIB Ruler	0
	WT Ruler	0
	Total	20
Errors in measurement due to non-familiarity with 45-90 system	APH Clip Ruler	0
	None	17.5
	RNIB Ruler	0
	WT Ruler	0
	Total	17.5
Wand movement causing drawing/measurement errors	APH Clip Ruler	0
	None	17.5
	RNIB Ruler	0
	WT Ruler	0
	Total	17.5

Struggled in reading measurement/Difficulty in understanding markings	APH Clip Ruler	0
	None	12.5
	RNIB Ruler	0
	WT Ruler	0
	Total	12.5
Drawing beyond edge of protractor/ruler for baseline	APH Clip Ruler	0
	None	12.5
	RNIB Ruler	0
	WT Ruler	0
	Total	12.5
Did not draw till end point	APH Clip Ruler	0
	None	12.5
	RNIB Ruler	0
	WT Ruler	0
	Total	12.5
Errors in using the short cut for measurement	APH Clip Ruler	0
	None	10
	RNIB Ruler	0
	WT Ruler	0
	Total	10
Board Turned to Draw	APH Clip Ruler	0
	None	7.5

	RNIB Ruler	0
	WT Ruler	0
	Total	7.5
Struggled in Placing the Protractor with right orientation	APH Clip Ruler	0
	None	7.5
	RNIB Ruler	0
	WT Ruler	0
	Total	7.5
Stylus not touching protractor/wand/ruler when drawing	APH Clip Ruler	0
	None	7.5
	RNIB Ruler	0
	WT Ruler	0
	Total	7.5
Careless counting /Measuring Mistakes	APH Clip Ruler	0
	None	7.5
	RNIB Ruler	0
	WT Ruler	0
	Total	7.5
Drawing not dark enough or long enough	APH Clip Ruler	0
	None	7.5
	RNIB Ruler	0
	WT Ruler	0

	Total	7.5
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Table 7.6 APH Wand Protractor: Skill 3 Training O-Y Variation (%)

O/Y Variation APH Wand Protractor	O	Y
Protractor/ Ruler movement whilst drawing baseline	10	30
Drawing beyond edge of protractor/ruler for baseline	20	5
Errors in using the short cut for measurement	20	0
Did not draw till end point	20	5
Errors in measurement due to non-familiarity with 45-90 system	30	5

Table 7.7 APH Wand Protractor: Skill 3 Test Key Issues (%)

		APH Wand Protractor Total
Difficulty in straightening the ruler/protractor/point markers for baseline drawing	APH Clip Ruler	0
	None	40
	RNIB Ruler	0
	WT Ruler	0
	Total	40
Struggled in Placing the Protractor with right orientation	APH Clip Ruler	0
	None	32.5
	RNIB Ruler	0
	WT Ruler	0
	Total	32.5
Did not draw till end point	APH Clip Ruler	0
	None	25
	RNIB Ruler	0
	WT Ruler	0
	Total	25
Stylus going underneath the	APH Clip	0

protractor/wand/ruler whilst drawing	Ruler	
	None	22.5
	RNIB Ruler	0
	WT Ruler	0
	Total	22.5
Careless counting /Measuring Mistakes	APH Clip Ruler	0
	None	22.5
	RNIB Ruler	0
	WT Ruler	0
	Total	22.5
Protractor/Ruler movement whilst drawing second arm	APH Clip Ruler	0
	None	20
	RNIB Ruler	0
	WT Ruler	0
	Total	20
Wand movement causing drawing/measurement errors	APH Clip Ruler	0
	None	17.5
	RNIB Ruler	0
	WT Ruler	0
	Total	17.5
Difficulty in placing the measurement point exactly at the groove/mark	APH Clip Ruler	0
	None	15
	RNIB Ruler	0
	WT Ruler	0
	Total	15
Cannot be Assessed	APH Clip	0

	Ruler	
	None	15
	RNIB Ruler	0
	WT Ruler	0
	Total	15
Drawing not dark enough or long enough	APH Clip Ruler	0
	None	12.5
	RNIB Ruler	0
	WT Ruler	0
	Total	12.5
Stylus not touching protractor/wand/ruler when drawing	APH Clip Ruler	0
	None	10
	RNIB Ruler	0
	WT Ruler	0
	Total	10

Table 7.8 APH Wand Protractor: Skill 3 Test O-Y Variation (%)

APH Wand Protractor OY Variation	APH Wand Protractor	
	older	younger
Difficulty in straightening the ruler/protractor/point markers for baseline drawing	55	25
Difficulty in placing the measurement point exactly at the groove/mark	10	20
Cannot be Assessed	10	20

Table 7.9 APH Wand Protractor: Skill 4 Training Key Issues (%)

		APH
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		Wand Outside Protract or
Struggled in aligning protractor to vertex and Baseline	Paper Total	35
	Plastic Sheet Total	30
	Thermofo rm Total	47.5
	Grand Total	37.5
Difficulty aligning wand to second arm pins	Paper Total	20
	Plastic Sheet Total	27.5
	Thermofo rm Total	15
	Grand Total	20.8333 3
Careless counting /Measuring Mistakes	Paper Total	12.5
	Plastic Sheet Total	25
	Thermofo rm Total	12.5
	Grand Total	16.6666 7
Errors/Difficulty in placing point pins on marked TDs/drawings (vertex/on arms)	Paper Total	17.5
	Plastic Sheet Total	20
	Thermofo rm Total	0
	Grand Total	12.5

Struggled in Placing the Protractor with right orientation	Paper Total	5
	Plastic Sheet Total	15
	Thermofo rm Total	12.5
	Grand Total	10.83333
Errors in using the short cut for measurement	Paper Total	7.5
	Plastic Sheet Total	7.5
	Thermofo rm Total	17.5
	Grand Total	10.83333
Errors in measurement due to non-familiarity with 45-90 system	Paper Total	7.5
	Plastic Sheet Total	7.5
	Thermofo rm Total	17.5
	Grand Total	10.83333
Wand movement causing drawing/measurement errors	Paper Total	10
	Plastic Sheet Total	17.5
	Thermofo rm Total	5
	Grand Total	10.83333
Struggled in reading measurement/Difficulty in understanding markings	Paper Total	2.5
	Plastic Sheet	5

	Total	
	Thermofo rm Total	5
	Grand Total	4.16666 7
Students Counting the start point mark as 10 instead of 10	Paper Total	2.5
	Plastic Sheet Total	2.5
	Thermofo rm Total	7.5
	Grand Total	4.16666 7
Protractor movement whilst plotting measurement/measurement	Paper Total	2.5
	Plastic Sheet Total	2.5
	Thermofo rm Total	5
	Grand Total	3.33333 3
Ruler/Protractor resting against wrong pins/Ruler Orientation causing drawing/measurement errors	Paper Total	5
	Plastic Sheet Total	5
	Thermofo rm Total	0
	Grand Total	3.33333 3
Difficulty in placing the measurement point exactly at the groove/mark	Paper Total	2.5
	Plastic Sheet Total	2.5
	Thermofo rm Total	2.5
	Grand Total	2.5

	Total	
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Table 7.10 APH Wand Protractor: Skill 4 Training O-Y Variation (%)

APH Wand Outside OY Variation			APH Wand Outside Protractor
Struggled in aligning protractor to vertex and Baseline	Plastic Sheet	O	40
		Y	20
Wand movement causing drawing/measurement errors	Plastic Sheet	O	10
		Y	25
Difficulty aligning wand to second arm pins	Plastic Sheet	O	40
		Y	15
Careless counting /Measuring Mistakes	Thermoform	O	5
		Y	20
Errors in using the short cut for measurement	Thermoform	O	5
		Y	30
Errors in measurement due to non-familiarity with 45-90 system	Thermoform	O	5
		Y	30
Errors/Difficulty in placing point pins on marked TDs/drawings (vertex/on arms)	Paper	O	25
		Y	10
Careless counting /Measuring Mistakes	Paper	O	5
		Y	20
Errors in using the short cut for measurement	Paper	O	0
		Y	15
Errors in measurement due to non-familiarity with 45-90 system	Paper	O	0
		Y	15
Wand movement causing drawing/measurement errors	Paper	O	0
		Y	20

Table 7.11 APH Wand Protractor: Skill 4 Test Key Issues (%)

		APH Wand Outside Protractor
Difficulty aligning wand to second arm pins	Paper Total	45

	Plastic Sheet Total	47.5
	Thermofo rm Total	50
	Grand Total	47.5
Struggled in aligning protractor to vertex and Baseline	Paper Total	47.5
	Plastic Sheet Total	50
	Thermofo rm Total	25
	Grand Total	40.83333
Careless counting /Measuring Mistakes	Paper Total	22.5
	Plastic Sheet Total	7.5
	Thermofo rm Total	22.5
	Grand Total	17.5
Struggled in Placing the Protractor with right orientation	Paper Total	10
	Plastic Sheet Total	10
	Thermofo rm Total	12.5
	Grand Total	10.83333
Errors/Difficulty in placing point pins on marked TDs/drawings (vertex/on arms)	Paper Total	15
	Plastic Sheet Total	15
	Thermofo	0

	rm Total	
	Grand Total	10
Errors in using the short cut for measurement	Paper Total	7.5
	Plastic Sheet Total	7.5
	Thermofo rm Total	5
	Grand Total	6.666667
Errors in measurement due to non-familiarity with 45-90 system	Paper Total	7.5
	Plastic Sheet Total	7.5
	Thermofo rm Total	2.5
	Grand Total	5.833333
Pin/clip little off and guessing measure	Paper Total	7.5
	Plastic Sheet Total	0
	Thermofo rm Total	7.5
	Grand Total	5
Cannot be Assessed	Paper Total	7.5
	Plastic Sheet Total	2.5
	Thermofo rm Total	2.5
	Grand Total	4.166667
Wand movement causing drawing/measurement errors	Paper	2.5

	Total	
	Plastic Sheet Total	5
	Thermofo rm Total	2.5
	Grand Total	3.333333
Right by Fluke	Paper Total	2.5
	Plastic Sheet Total	0
	Thermofo rm Total	7.5
	Grand Total	3.333333

Table 7.12 APH Wand Protractor: Skill 4 Test O-Y Variation (%)

APH Wand Outside Protractor O-Y Variation			APH Wand Outside Protractor
Struggled in Placing the Protractor with right orientation	Plastic Sheet	Older	15.78947
		Younger	4.761905
Struggled in aligning protractor to vertex and Baseline	Thermoform	Older	15.7894
		Younger	33.3333
Errors/Difficulty in placing point pins on marked TDs/drawings (vertex/on arms)	Paper	Older	21.0526
		Younger	9.5238
Errors/Difficulty in placing point pins on marked TDs/drawings (vertex/on arms)	Plastic Sheet	Older	21.0526
		Younger	9.5238
Careless counting /Measuring Mistakes	Plastic Sheet	Older	
		Younger	14.2857
Errors in using the short cut for measurement	Paper	Older	
		Younger	14.2857
Errors in measurement due to non-familiarity with 45-90 system	Paper	Older	
		Younger	14.2857

Table 7.13 Garg Protractor: Skill 3 Training Key Issues (%)

		Garg Protractor Total
Struggled in fixing line marker on point markers and protractor measurement grooves	APH Clip Ruler	0
	None	37.5
	RNIB Ruler	0
	WT Ruler	0
	Total	37.5
Difficulty in using Garg Stylus	APH Clip Ruler	0
	None	32.5
	RNIB Ruler	0
	WT Ruler	0
	Total	32.5
Line marker moved whilst drawing	APH Clip Ruler	0
	None	27.5
	RNIB Ruler	0
	WT Ruler	0
	Total	27.5
Drawing beyond vertex point	APH Clip Ruler	0
	None	17.5
	RNIB Ruler	0
	WT Ruler	0
	Total	17.5
Difficulty in straightening the ruler/protractor/point markers for baseline drawing	APH Clip Ruler	0
	None	15
	RNIB Ruler	0
	WT Ruler	0
	Total	15
Struggled in reading measurement/Difficulty in understanding markings	APH Clip Ruler	0
	None	12.5
	RNIB Ruler	0
	WT Ruler	0
	Total	12.5
Difficulty in placing the protractor flat on the point	APH Clip	0

marker	Ruler	
	None	12.5
	RNIB Ruler	0
	WT Ruler	0
	Total	12.5
Struggled in Immobilizing the paper	APH Clip Ruler	0
	None	10
	RNIB Ruler	0
	WT Ruler	0
	Total	10
Struggled in pushing pins in the board/Struggled in sliding point markers to position	APH Clip Ruler	0
	None	10
	RNIB Ruler	0
	WT Ruler	0
	Total	10
Did not draw till end point	APH Clip Ruler	0
	None	10
	RNIB Ruler	0
	WT Ruler	0
	Total	10
Drawing beyond line markers causing tears	APH Clip Ruler	0
	None	10
	RNIB Ruler	0
	WT Ruler	0
	Total	10
Board Turned to Draw	APH Clip Ruler	0
	None	7.5
	RNIB Ruler	0
	WT Ruler	0
	Total	7.5
Point markers moving after drawing baseline	APH Clip Ruler	0
	None	5
	RNIB Ruler	0

	WT Ruler	0
	Total	5
Struggle using long line marker	APH Clip Ruler	0
	None	5
	RNIB Ruler	0
	WT Ruler	0
	Total	5
Line creasing due to holding down line marker causing extend lines and confusion	APH Clip Ruler	0
	None	5
	RNIB Ruler	0
	WT Ruler	0
	Total	5

Table 7.14 Garg Protractor: Skill 3 Training O-Y Variation (%)

O/Y Variation Garg Protractor	O	Y
Struggled in Immobilizing the paper	0	20
Struggled in pushing pins in the board/Struggled in sliding point markers to position	5	15
Difficulty in straightening the ruler/protractor/point markers for baseline drawing	10	20
Drawing beyond vertex point	25	10
Did not draw till end point	15	5
Drawing beyond line markers causing tears	5	15

Table 7.15 .Garg Protractor: Skill 3 Test Key Issues (%)

		Garg Protract or Total
Struggled in fixing line marker on point markers and protractor measurement grooves	APH Clip Ruler	0
	None	37.5
	RNIB Ruler	0
	WT Ruler	0

	Total	37.5
Difficulty in straightening the ruler/protractor/point markers for baseline drawing	APH Clip Ruler	0
	None	30
	RNIB Ruler	0
	WT Ruler	0
	Total	30
Difficulty in using Garg Stylus	APH Clip Ruler	0
	None	17.5
	RNIB Ruler	0
	WT Ruler	0
	Total	17.5
Careless counting /Measuring Mistakes	APH Clip Ruler	0
	None	15
	RNIB Ruler	0
	WT Ruler	0
	Total	15
Drawing beyond vertex point	APH Clip Ruler	0
	None	15
	RNIB Ruler	0
	WT Ruler	0
	Total	15
Difficulty in placing the protractor flat on the point marker	APH Clip Ruler	0

	None	15
	RNIB Ruler	0
	WT Ruler	0
	Total	15
Point markers moving after drawing baseline	APH Clip Ruler	0
	None	15
	RNIB Ruler	0
	WT Ruler	0
	Total	15
Cannot be Assessed	APH Clip Ruler	0
	None	15
	RNIB Ruler	0
	WT Ruler	0
	Total	15
Board Turned to Draw	APH Clip Ruler	0
	None	10
	RNIB Ruler	0
	WT Ruler	0
	Total	10
Did not draw till end point	APH Clip Ruler	0
	None	10
	RNIB Ruler	0
	WT	0

	Ruler	
	Total	10
Line marker moved whilst drawing	APH Clip Ruler	0
	None	10
	RNIB Ruler	0
	WT Ruler	0
	Total	10
Drawing not dark enough or long enough	APH Clip Ruler	0
	None	7.5
	RNIB Ruler	0
	WT Ruler	0
	Total	7.5

Table 7.16 Garg Protractor: Skill 3 Test O-Y Variation (%)

		Older	Young er
Board Turned to Draw	None	15	5
Drawing beyond vertex point	None	20	10
Did not draw till end point	None	5	15
Point markers moving after drawing baseline	None	10	20

Table 7.17 Garg Protractor: Skill 4 Training Key Issues (%)

		Garg Protract or
--	--	------------------------

Errors/Difficulty in placing point pins on marked TDs/drawings (vertex/on arms)	Paper Total	45
	Plastic Sheet Total	0
	Thermofo rm Total	0
	Grand Total	45
Struggled in fixing line marker on point markers and protractor measurement grooves	Paper Total	30
	Plastic Sheet Total	0
	Thermofo rm Total	0
	Grand Total	30
Careless counting /Measuring Mistakes	Paper Total	17.5
	Plastic Sheet Total	0
	Thermofo rm Total	0
	Grand Total	17.5
Struggled in Immobilizing the paper	Paper Total	15
	Plastic Sheet Total	0
	Thermofo rm Total	0
	Grand Total	15
Difficulty in placing the protractor flat on the point marker	Paper Total	15
	Plastic Sheet	0

	Total	
	Thermofo rm Total	0
	Grand Total	15
Struggled in reading measurement/Difficulty in understanding markings	Paper Total	12.5
	Plastic Sheet Total	0
	Thermofo rm Total	0
	Grand Total	12.5
Struggled in pushing pins in the board/Struggled in sliding point markers to position	Paper Total	10
	Plastic Sheet Total	0
	Thermofo rm Total	0
	Grand Total	10

Table 7.18 Garg Protractor: Skill Training O-Y Variation (%)

Garg Protractor OY Variations			Garg Protract or
Struggled in reading measurement/Difficulty in understanding markings	Pape r	O	5
		Y	20
Careless counting /Measuring Mistakes	Pape r	O	10
		Y	25

Table 7.19 .Garg Protractor: Skill 4 Test Key Issues (%)

		Garg
--	--	------

		Protract or
Errors/Difficulty in placing point pins on marked TDs/drawings (vertex/on arms)	Paper Total	47.5
	Plastic Sheet Total	0
	Thermoform Total	0
	Grand Total	47.5
Difficulty in placing the protractor flat on the point marker	Paper Total	30
	Plastic Sheet Total	0
	Thermoform Total	0
	Grand Total	30
Struggled in fixing line marker on point markers and protractor measurement grooves	Paper Total	22.5
	Plastic Sheet Total	0
	Thermoform Total	0
	Grand Total	22.5
Struggled in aligning protractor to vertex and Baseline	Paper Total	17.5
	Plastic Sheet Total	0
	Thermoform Total	0
	Grand Total	17.5
Careless counting /Measuring Mistakes	Paper Total	17.5
	Plastic Sheet Total	0
	Thermoform Total	0

	Grand Total	17.5
Struggled in Placing the Protractor with right orientation	Paper Total	12.5
	Plastic Sheet Total	0
	Thermoform Total	0
	Grand Total	12.5

Table 7.20 Garg Protractor: Skill 4 Test O-Y Variation (%)

Garg Protractor OY Variation			Garg Protractor
Careless counting /Measuring Mistakes	Paper	Older	5.263158
		Younger	28.57143
Struggled in fixing line marker on point markers and protractor measurement grooves	Paper	Older	31.57895
		Younger	14.28571

Table 7.21 RNIB Protractor: Skill 3 Training Key Issues (%)

		RNIB Protractor Total
Protractor slipping under the knob	APH Clip Ruler	24.32432
	None	0
	RNIB Ruler	25.64103
	WT Ruler	35.13514
	Total	28.31858
Struggled in aligning protractor to vertex and Baseline	APH Clip Ruler	18.91892
	None	0
	RNIB Ruler	23.07692
	WT Ruler	32.43243
	Total	24.77876
Difficulty in straightening the ruler/protractor/point markers for baseline drawing	APH Clip Ruler	16.21622
	None	0
	RNIB Ruler	10.25641
	WT Ruler	40.54054

	Total	22.12389
Ruler/Protractor resting against wrong pins/Ruler Orientation causing drawing/measurement errors	APH Clip Ruler	24.32432
	None	0
	RNIB Ruler	25.64103
	WT Ruler	13.51351
	Total	21.23894
Protractor movement whilst plotting measurement/measurement	APH Clip Ruler	8.108108
	None	0
	RNIB Ruler	15.38462
	WT Ruler	21.62162
	Total	15.04425
Did not draw till end point	APH Clip Ruler	5.405405
	None	0
	RNIB Ruler	17.94872
	WT Ruler	13.51351
	Total	12.38938
Errors/Difficulty in placing point pins on marked TDs/drawings (vertex/on arms)	APH Clip Ruler	5.405405
	None	0
	RNIB Ruler	20.51282
	WT Ruler	8.108108
	Total	11.50442
Gap between pin and ruler/protractor whilst drawing/measurement causing errors	APH Clip Ruler	10.81081
	None	0
	RNIB Ruler	20.51282
	WT Ruler	2.702703
	Total	11.50442
Struggles with (RNIB) Knob	APH Clip Ruler	5.405405
	None	0
	RNIB Ruler	23.07692
	WT Ruler	2.702703
	Total	10.61947
Protractor movement whilst immobilizing	APH Clip Ruler	8.108108
	None	0
	RNIB Ruler	7.692308
	WT Ruler	13.51351
	Total	9.734513
Using wrong side of the ruler	APH Clip Ruler	0
	None	0
	RNIB Ruler	28.20513

	WT Ruler	0
	Total	9.734513
Protractor/ Ruler movement whilst drawing baseline	APH Clip Ruler	2.702703
	None	0
	RNIB Ruler	10.25641
	WT Ruler	10.81081
	Total	7.964602
Stylus not touching protractor/wand/ruler when drawing	APH Clip Ruler	5.405405
	None	0
	RNIB Ruler	10.25641
	WT Ruler	8.108108
	Total	7.964602
Protractor/Ruler movement whilst drawing second arm	APH Clip Ruler	2.702703
	None	0
	RNIB Ruler	2.564103
	WT Ruler	16.21622
	Total	7.079646
coming off whilst trying to remove the knob	APH Clip Ruler	8.108108
	None	0
	RNIB Ruler	7.692308
	WT Ruler	5.405405
	Total	7.079646
Struggled in reading measurement/Difficulty in understanding markings	APH Clip Ruler	13.51351
	None	0
	RNIB Ruler	2.564103
	WT Ruler	2.702703
	Total	6.19469
Drawing beyond vertex point	APH Clip Ruler	5.405405
	None	0
	RNIB Ruler	7.692308
	WT Ruler	2.702703
	Total	5.309735
Drawing not dark enough or long enough	APH Clip Ruler	5.405405
	None	0
	RNIB Ruler	2.564103
	WT Ruler	8.108108
	Total	5.309735
Difficulty in placing the measurement point exactly at the groove/mark	APH Clip Ruler	5.405405
	None	0

	RNIB Ruler	5.128205
	WT Ruler	5.405405
	Total	5.309735
Putting pins off the immobilization grooves of protractor making the protractor move	APH Clip Ruler	2.702703
	None	0
	RNIB Ruler	5.128205
	WT Ruler	8.108108
	Total	5.309735
Struggled in finding Free Space to draw	APH Clip Ruler	0
	None	0
	RNIB Ruler	5.128205
	WT Ruler	8.108108
	Total	4.424779
Struggled Drawing on the sheet	APH Clip Ruler	5.405405
	None	0
	RNIB Ruler	5.128205
	WT Ruler	0
	Total	3.539823
Stylus going underneath the protractor/wand/ruler whilst drawing	APH Clip Ruler	0
	None	0
	RNIB Ruler	2.564103
	WT Ruler	8.108108
	Total	3.539823
Careless counting /Measuring Mistakes	APH Clip Ruler	2.702703
	None	0
	RNIB Ruler	5.128205
	WT Ruler	2.702703
	Total	3.539823
Board Turned to Draw	APH Clip Ruler	0
	None	0
	RNIB Ruler	2.564103
	WT Ruler	5.405405
	Total	2.654867
Errors in using the short cut for measurement	APH Clip Ruler	8.108108
	None	0
	RNIB Ruler	0
	WT Ruler	0
	Total	2.654867

Table 7.22 RNIB Protractor: Skill 3 Training O-Y Variation (%)

O/Y variation RNIB Protractor		O	Y
Protractor movement whilst plotting measurement/measurement	WT Ruler	29.4117 6	15
Struggled in aligning protractor to vertex and Baseline	RNIB Ruler	31.5789 5	15
Struggled in reading measurement/Difficulty in understanding markings	APH Clip Ruler	0	25
Did not draw till end point	RNIB Ruler	10.5263 2	25
Did not draw till end point	WT Ruler	23.5294 1	5
Gap between pin and ruler/protractor whilst drawing/measurement causing errors	APH Clip Ruler	5.88235 3	15
Ruler/Protractor resting against wrong pins/Ruler Orientation causing drawing/measurement errors	WT Ruler	0	25
Using wrong side of the ruler	RNIB Ruler	21.0526 3	35

Table 7.23 RNIB Protractor: Skill 3 Test Key Issues

		RNIB Protractor Total
Struggled in aligning protractor to vertex and Baseline	APH Clip Ruler	50
	None	0
	RNIB Ruler	40
	WT Ruler	45
	Total	45
Difficulty in straightening the ruler/protractor/point markers for baseline drawing	APH Clip Ruler	30
	None	0
	RNIB Ruler	22.5

	WT Ruler	32.5
	Total	28.33333
Errors/Difficulty in placing point pins on marked TDs/drawings (vertex/on arms)	APH Clip Ruler	12.5
	None	0
	RNIB Ruler	17.5
	WT Ruler	27.5
	Total	19.16667
Did not draw till end point	APH Clip Ruler	17.5
	None	0
	RNIB Ruler	22.5
	WT Ruler	15
	Total	18.33333
Struggles with (RNIB) Knob	APH Clip Ruler	12.5
	None	0
	RNIB Ruler	15
	WT Ruler	27.5
	Total	18.33333
Protractor slipping under the knob	APH Clip Ruler	10
	None	0
	RNIB Ruler	12.5
	WT Ruler	22.5
	Total	15
Ruler/Protractor resting against wrong pins/Ruler	APH	25

Orientation causing drawing/measurement errors	Clip Ruler	
	None	0
	RNIB Ruler	10
	WT Ruler	7.5
	Total	14.16667
Struggled in finding Free Space to draw	APH Clip Ruler	12.5
	None	0
	RNIB Ruler	0
	WT Ruler	20
	Total	10.83333
Stylus not touching protractor/wand/ruler when drawing	APH Clip Ruler	10
	None	0
	RNIB Ruler	7.5
	WT Ruler	12.5
	Total	10
Gap between pin and ruler/protractor whilst drawing/measurement causing errors	APH Clip Ruler	12.5
	None	0
	RNIB Ruler	12.5
	WT Ruler	5
	Total	10
Cannot be Assessed	APH Clip Ruler	7.5
	None	0
	RNIB	12.5

	Ruler	
	WT Ruler	10
	Total	10
Protractor movement whilst plotting measurement/measurement	APH Clip Ruler	7.5
	None	0
	RNIB Ruler	7.5
	WT Ruler	12.5
	Total	9.166667
Protractor/Ruler movement whilst drawing second arm	APH Clip Ruler	10
	None	0
	RNIB Ruler	5
	WT Ruler	7.5
	Total	7.5
Drawing beyond vertex point	APH Clip Ruler	5
	None	0
	RNIB Ruler	5
	WT Ruler	10
	Total	6.666667
Using wrong side of the ruler	APH Clip Ruler	0
	None	0
	RNIB Ruler	20
	WT Ruler	0
	Total	6.666667

Struggled in Placing the Protractor with right orientation	APH Clip Ruler	7.5
	None	0
	RNIB Ruler	2.5
	WT Ruler	7.5
	Total	5.833333
Careless counting /Measuring Mistakes	APH Clip Ruler	12.5
	None	0
	RNIB Ruler	2.5
	WT Ruler	2.5
	Total	5.833333
Right by Fluke	APH Clip Ruler	5
	None	0
	RNIB Ruler	5
	WT Ruler	7.5
	Total	5.833333
Difficulty in placing the measurement point exactly at the groove/mark	APH Clip Ruler	5
	None	0
	RNIB Ruler	2.5
	WT Ruler	5
	Total	4.166667
Board Turned to Draw	APH Clip Ruler	2.5
	None	0

	RNIB Ruler	2.5
	WT Ruler	5
	Total	3.333333
Protractor/ Ruler movement whilst drawing baseline	APH Clip Ruler	0
	None	0
	RNIB Ruler	7.5
	WT Ruler	2.5
	Total	3.333333
Stylus going underneath the protractor/wand/ruler whilst drawing	APH Clip Ruler	2.5
	None	0
	RNIB Ruler	0
	WT Ruler	5
	Total	2.5

Table 7.24 RNIB Protractor: Skill 3 Test O-Y Variation

RNIB Protractor OY Variation		RNIB Protractor	
		Older	Younger
Struggled in Placing the Protractor with right orientation	WT Ruler	0	15
Difficulty in straightening the ruler/protractor/point markers for baseline drawing	RNIB Ruler	10	35
Stylus not touching protractor/wand/ruler when drawing	APH Clip Ruler	0	20
Stylus not touching protractor/wand/ruler when drawing	WT Ruler	0	25
Did not draw till end point	WT Ruler	0	30
Gap between pin and ruler/protractor whilst drawing/measurement causing errors	APH Clip Ruler	20	5

Gap between pin and ruler/protractor whilst drawing/measurement causing errors	RNIB Ruler	20	5
Struggles with (RNIB) Knob	APH Clip Ruler	20	5
Cannot be Assessed	RNIB Ruler	5	20
Cannot be Assessed	WT Ruler	5	15
Protractor slipping under the knob	WT Ruler	15	30

Table 7.25 RNIB Protractor: Skill 4 Training Key Issues

		RNIB Protract or
Struggled in aligning protractor to vertex and Baseline	Paper Total	30
	Plastic Sheet Total	30
	Thermofo rm Total	27.5
	Grand Total	29.1666 7
Careless counting /Measuring Mistakes	Paper Total	17.5
	Plastic Sheet Total	25
	Thermofo rm Total	27.5
	Grand Total	23.3333 3
Errors/Difficulty in placing point pins on marked TDs/drawings (vertex/on arms)	Paper Total	5
	Plastic Sheet Total	32.5
	Thermofo rm Total	17.5
	Grand Total	18.3333 3
Protractor slipping under the knob	Paper Total	10
	Plastic Sheet Total	17.5
	Thermofo rm Total	5
	Grand	10.8333

	Total	3
Protractor movement whilst plotting measurement/measurement	Paper Total	5
	Plastic Sheet Total	10
	Thermofo rm Total	7.5
	Grand Total	7.5
Struggles with (RNIB) Knob	Paper Total	10
	Plastic Sheet Total	7.5
	Thermofo rm Total	5
	Grand Total	7.5
Struggled in Placing the Protractor with right orientation	Paper Total	2.5
	Plastic Sheet Total	5
	Thermofo rm Total	7.5
	Grand Total	5
Struggled in measuring because the TD size was small and protractor covered the second arm	Paper Total	10
	Plastic Sheet Total	5
	Thermofo rm Total	0
	Grand Total	5
Struggled in reading measurement/Difficulty in understanding markings	Paper Total	0
	Plastic	2.5

	Sheet Total	
	Thermoform Total	7.5
	Grand Total	3.333333

Table 7.26 .RNIB Protractor: Skill 4 Training O-Y Variation

RNIB Protractor OY Variation			RNIB Protractor
Protractor movement whilst plotting measurement/measurement	Plastic Sheet	O	
		Y	
Protractor slipping under the knob	Plastic Sheet	O	
		Y	
Errors/Difficulty in placing point pins on marked TDs/drawings (vertex/on arms)	Thermoform	O	
		Y	
Struggles with (RNIB) Knob	Paper	O	
		Y	
Struggled in measuring because the TD size was small and protractor covered the second arm	Paper	O	
		Y	

Table 7.27 RNIB Protractor: Skill 4 Test Key Issues (%)

		RNIB Protractor
Struggled in aligning protractor to vertex and Baseline	Paper Total	35
	Plastic Sheet Total	47.5
	Thermoform Total	42.5
	Grand Total	41.66667
Careless counting /Measuring Mistakes	Paper Total	22.5
	Plastic Sheet Total	17.5
	Thermoform Total	22.5
	Grand Total	20.83333
Errors/Difficulty in placing point pins on marked TDs/drawings (vertex/on arms)	Paper Total	15
	Plastic Sheet Total	22.5
	Thermoform Total	7.5
	Grand Total	15
Struggles with (RNIB) Knob	Paper Total	10
	Plastic Sheet Total	10
	Thermoform Total	15
	Grand Total	11.66667
Protractor slipping under the knob	Paper Total	10
	Plastic Sheet Total	15
	Thermoform Total	7.5
	Grand Total	10.83333

Right by Fluke	Paper Total	7.5
	Plastic Sheet Total	12.5
	Thermoform Total	2.5
	Grand Total	7.5
Pin/clip little off and guessing measure	Paper Total	7.5
	Plastic Sheet Total	10
	Thermoform Total	2.5
	Grand Total	6.666667
Struggled in Placing the Protractor with right orientation	Paper Total	2.5
	Plastic Sheet Total	5
	Thermoform Total	2.5
	Grand Total	3.333333
Protractor movement whilst plotting measurement/measurement	Paper Total	0
	Plastic Sheet Total	2.5
	Thermoform Total	7.5
	Grand Total	3.333333

Table 7.28 RNIB Protractor: Skill Test O-Y Variation (%)

RNIB Protractor OY Variation			RNIB Protractor
Protractor movement whilst plotting measurement/measurement	Thermoform	Older	0
		Younger	14.28571
Struggled in aligning protractor to vertex and Baseline	Paper	Older	21.05263
		Younger	47.61905
Struggled in aligning protractor to vertex and Baseline	Thermoform	Older	21.05263
		Younger	61.90476
Errors/Difficulty in placing point pins on marked	Plastic Sheet	Older	15.78947

TDs/drawings (vertex/on arms)		Younger	28.57143
Careless counting /Measuring Mistakes	Paper	Older	15.78947
		Younger	28.57143
Protractor slipping under the knob	Paper	Older	5.263158
		Younger	14.28571
Protractor slipping under the knob	Plastic Sheet	Older	10.52632
		Younger	19.04762
Struggles with (RNIB) Knob	Thermoform	Older	21.05263
		Younger	9.52381
Pin/clip little off and guessing measure	Paper	Older	0
		Younger	14.28571

Table 7.29 Worth Trust Protractor: Skill 3 Training Key Issues (%)

		WT Protracto r Total
Struggled in aligning protractor to vertex and Baseline	APH Clip Ruler	26.31579
	None	0
	RNIB Ruler	80
	WT Ruler	35.89744
	Total	34.18803
Gap between pin and ruler/protractor whilst drawing/measurement causing errors	APH Clip Ruler	26.31579
	None	0
	RNIB Ruler	45
	WT Ruler	15.38462
	Total	21.36752
Difficulty in straightening the ruler/protractor/point markers for baseline drawing	APH Clip Ruler	21.05263
	None	0
	RNIB	10

	Ruler	
	WT Ruler	35.89744
	Total	20.51282
Ruler/Protractor resting against wrong pins/Ruler Orientation causing drawing/measurement errors	APH Clip Ruler	23.68421
	None	0
	RNIB Ruler	40
	WT Ruler	5.128205
	Total	16.23932
Protractor movement whilst immobilizing	APH Clip Ruler	10.52632
	None	0
	RNIB Ruler	10
	WT Ruler	23.07692
	Total	12.82051
Errors/Difficulty in placing point pins on marked TDs/drawings (vertex/on arms)	APH Clip Ruler	13.15789
	None	0
	RNIB Ruler	15
	WT Ruler	15.38462
	Total	11.96581
Protractor/Ruler movement whilst drawing second arm	APH Clip Ruler	7.894737
	None	0
	RNIB Ruler	25
	WT Ruler	12.82051
	Total	11.11111

Did not draw till end point	APH Clip Ruler	7.894737
	None	0
	RNIB Ruler	40
	WT Ruler	5.128205
	Total	11.11111
Using wrong side of the ruler	APH Clip Ruler	2.631579
	None	0
	RNIB Ruler	60
	WT Ruler	0
	Total	11.11111
Drawing not dark enough or long enough	APH Clip Ruler	7.894737
	None	0
	RNIB Ruler	25
	WT Ruler	10.25641
	Total	10.25641
Difficulty in placing the measurement point exactly at the groove/mark	APH Clip Ruler	7.894737
	None	0
	RNIB Ruler	15
	WT Ruler	15.38462
	Total	10.25641
Stylus not touching protractor/wand/ruler when drawing	APH Clip Ruler	13.15789
	None	0

	RNIB Ruler	15
	WT Ruler	7.692308
	Total	9.401709
Careless counting /Measuring Mistakes	APH Clip Ruler	18.42105
	None	0
	RNIB Ruler	10
	WT Ruler	5.128205
	Total	9.401709
Slipping of potractor at vertex point pin (WT)	APH Clip Ruler	5.263158
	None	0
	RNIB Ruler	20
	WT Ruler	7.692308
	Total	7.692308
Protractor/ Ruler movement whilst drawing baseline	APH Clip Ruler	5.263158
	None	0
	RNIB Ruler	10
	WT Ruler	10.25641
	Total	6.837607
Struggled in findiging Free Space to draw	APH Clip Ruler	10.52632
	None	0
	RNIB Ruler	10
	WT Ruler	2.564103

	Total	5.982906
Struggled in Placing the Protractor with right orientation	APH Clip Ruler	5.263158
	None	0
	RNIB Ruler	10
	WT Ruler	5.128205
	Total	5.128205
Struggled in reading measurement/Difficulty in understanding markings	APH Clip Ruler	2.631579
	None	0
	RNIB Ruler	10
	WT Ruler	7.692308
	Total	5.128205
Drawing beyond vertex point	APH Clip Ruler	2.631579
	None	0
	RNIB Ruler	5
	WT Ruler	10.25641
	Total	5.128205
Board Turned to Draw	APH Clip Ruler	2.631579
	None	0
	RNIB Ruler	5
	WT Ruler	5.128205
	Total	3.418803
Stylus going underneath the protractor/wand/ruler whilst drawing	APH Clip Ruler	0

	None	0
	RNIB Ruler	0
	WT Ruler	10.25641
	Total	3.418803
Removing wrong pins whilst removing the protractor for drawing	APH Clip Ruler	5.263158
	None	0
	RNIB Ruler	5
	WT Ruler	2.564103
	Total	3.418803
Struggled Drawing on the sheet	APH Clip Ruler	0
	None	0
	RNIB Ruler	10
	WT Ruler	2.564103
	Total	2.564103
Drawing beyond edge of protractor/ruler for baseline	APH Clip Ruler	0
	None	0
	RNIB Ruler	0
	WT Ruler	7.692308
	Total	2.564103
Aligning the wrong tip of the protractor to the vertex point	APH Clip Ruler	2.631579
	None	0
	RNIB Ruler	0
	WT	2.564103

	Ruler	
	Total	1.709402

Table 7.30 Worth Trust Protractor: Skill 3 Training O-Y Variation (%)

O/Y variation WT Protractor		O	Y
Protractor/Ruler movement whilst drawing second arm	RNIB Ruler	0	25
Protractor/Ruler movement whilst drawing second arm	WT Ruler	21.05263	5
Stylus going underneath the protractor/wand/ruler whilst drawing	WT Ruler	21.05263	0
Errors/Difficulty in placing point pins on marked TDs/drawings (vertex/on arms)	APH Clip Ruler	5.555556	20
Errors/Difficulty in placing point pins on marked TDs/drawings (vertex/on arms)	WT Ruler	10.52632	20
Drawing beyond vertex point	WT Ruler	15.78947	5
Gap between pin and ruler/protractor whilst drawing/measurement causing errors	APH Clip Ruler	16.66667	35
Gap between pin and ruler/protractor whilst drawing/measurement causing errors	RNIB Ruler	30	15
Difficulty in placing the measurement point exactly at the groove/mark	RNIB Ruler	15	0

Table 7.31 Worth Trust Protractor: Skill 3 Test Key Issues (%)

		WT Protractor Total
		Total
Struggled in aligning protractor to vertex and Baseline	APH Clip Ruler	35
	None	0
	RNIB Ruler	40
	WT Ruler	40
	Total	38.33333
Difficulty in straightening the ruler/protractor/point markers for baseline drawing	APH Clip Ruler	22.5
	None	0
	RNIB Ruler	15
	WT Ruler	37.5
	Total	25
Errors/Difficulty in placing point	APH Clip Ruler	15

pins on marked TDs/drawings (vertex/on arms)	None	0
	RNIB Ruler	20
	WT Ruler	27.5
	Total	20.83333
Ruler/Protractor resting against wrong pins/Ruler Orientation causing drwaing/measurement errors	APH Clip Ruler	25
	None	0
	RNIB Ruler	15
	WT Ruler	10
	Total	16.66667
Did not draw till end point	APH Clip Ruler	10
	None	0
	RNIB Ruler	17.5
	WT Ruler	10
	Total	12.5
Stylus not touching protractor/wand/ruler when drawing	APH Clip Ruler	5
	None	0
	RNIB Ruler	17.5
	WT Ruler	12.5
	Total	11.66667
Careless counting /Measuring Mistakes	APH Clip Ruler	7.5
	None	0
	RNIB Ruler	17.5
	WT Ruler	5
	Total	10
Slipping of protractor at vertex point pin (WT)	APH Clip Ruler	5
	None	0
	RNIB Ruler	12.5
	WT Ruler	7.5
	Total	8.333333
Cannot be Assessed	APH Clip Ruler	10
	None	0
	RNIB Ruler	5
	WT Ruler	10
	Total	8.333333
Struggled in Placing the Protractor with right orientation	APH Clip Ruler	10
	None	0
	RNIB Ruler	7.5
	WT Ruler	5
	Total	7.5

Protractor/Ruler movement whilst drawing second arm	APH Clip Ruler	7.5
	None	0
	RNIB Ruler	2.5
	WT Ruler	12.5
	Total	7.5
Protractor movement whilst plotting measurement/measurement	APH Clip Ruler	5
	None	0
	RNIB Ruler	12.5
	WT Ruler	2.5
	Total	6.666667
Drawing not dark enough or long enough	APH Clip Ruler	10
	None	0
	RNIB Ruler	2.5
	WT Ruler	7.5
	Total	6.666667
Struggled in finding Free Space to draw	APH Clip Ruler	5
	None	0
	RNIB Ruler	0
	WT Ruler	12.5
	Total	5.833333
Protractor/ Ruler movement whilst drawing baseline	APH Clip Ruler	2.5
	None	0
	RNIB Ruler	7.5
	WT Ruler	7.5
	Total	5.833333
Drawing beyond vertex point	APH Clip Ruler	10
	None	0
	RNIB Ruler	2.5
	WT Ruler	5
	Total	5.833333
Difficulty in placing the measurement point exactly at the groove/mark	APH Clip Ruler	10
	None	0
	RNIB Ruler	2.5
	WT Ruler	5
	Total	5.833333
Using wrong side of the ruler	APH Clip Ruler	0
	None	0
	RNIB Ruler	15
	WT Ruler	0

	Total	5
Board Turned to Draw	APH Clip Ruler	5
	None	0
	RNIB Ruler	2.5
	WT Ruler	5
	Total	4.166667
Gap between pin and ruler/protractor whilst drawing/measurement causing errors	APH Clip Ruler	5
	None	0
	RNIB Ruler	2.5
	WT Ruler	2.5
	Total	3.333333
Right by Fluke	APH Clip Ruler	2.5
	None	0
	RNIB Ruler	5
	WT Ruler	0
	Total	2.5

Table 7.32 Worth Trust Protractor: Skill 3 Test O-Y Variation (%)

	Row Label	Older	Younger
Protractor/ Ruler movement whilst drawing baseline	WT Ruler	15	0
Protractor/Ruler movement whilst drawing second arm	APH Clip Ruler	0	15
Struggled in aligning protractor to vertex and Baseline	APH Clip Ruler	20	50
Stylus not touching protractor/wand/ruler when drawing	RNIB Ruler	10	25
Stylus not touching protractor/wand/ruler when drawing	WT Ruler	5	20
Errors/Difficulty in placing point pins on marked TDs/drawings (vertex/on arms)	RNIB Ruler	30	10
Errors/Difficulty in placing point pins on marked TDs/drawings (vertex/on arms)	WT Ruler	40	15
Did not draw till end point	RNIB Ruler	30	5
Drawing not dark enough or long enough	WT	0	15

	Ruler		
Ruler/Protractor resting against wrong pins/Ruler Orientation causing drawing/measurement errors	RNIB Ruler	20	10
Using wrong side of the ruler	RNIB Ruler	5	25
Cannot be Assessed	APH Clip Ruler	0	20

Table 7.33 Worth Trust Protractor: Skill 4 Training Key Issues (%)

		WT Protractor
Struggled in aligning protractor to vertex and Baseline	Paper Total	38.75
	Plastic Sheet Total	35.44304
	Thermofor m Total	55
	Grand Total	40.70352
Careless counting /Measuring Mistakes	Paper Total	22.5
	Plastic Sheet Total	26.58228
	Thermofor m Total	32.5
	Grand Total	26.13065
Errors/Difficulty in placing point pins on marked TDs/drawings (vertex/on arms)	Paper Total	11.25
	Plastic Sheet Total	18.98734
	Thermofor m Total	0
	Grand Total	12.0603

Protractor movement whilst plotting measurement/measurement	Paper Total	8.75
	Plastic Sheet Total	11.39241
	Thermoform Total	10
	Grand Total	10.05025
Slipping of protractor at vertex point pin (WT)	Paper Total	3.75
	Plastic Sheet Total	8.860759
	Thermoform Total	0
	Grand Total	5.025126
Struggled in reading measurement/Difficulty in understanding markings	Paper Total	3.75
	Plastic Sheet Total	2.531646
	Thermoform Total	7.5
	Grand Total	4.020101
Protractor movement whilst immobilizing	Paper Total	5
	Plastic Sheet Total	5.063291
	Thermoform Total	0
	Grand Total	4.020101
Pin/clip little off and guessing measure	Paper Total	5
	Plastic Sheet	2.531646

	Total	
	Thermoform Total	0
	Grand Total	3.015075
TDs not distinct enough	Paper Total	1.25
	Plastic Sheet Total	5.063291
	Thermoform Total	2.5
	Grand Total	3.015075
Aligning the wrong tip of the protractor to the vertex point	Paper Total	2.5
	Plastic Sheet Total	2.531646
	Thermoform Total	2.5
	Grand Total	2.512563
Struggled in Placing the Protractor with right orientation	Paper Total	1.25
	Plastic Sheet Total	1.265823
	Thermoform Total	5
	Grand Total	2.01005
Difficulty in placing the measurement point exactly at the groove/mark	Paper Total	1.25
	Plastic Sheet Total	3.797468
	Thermoform Total	0
	Grand Total	2.01005

	Total	
Struggled in aligning the sheet to the mat	Paper Total	0
	Plastic Sheet Total	1.265823
	Thermoform Total	5
	Grand Total	1.507538

Table 7.34 Worth Trust Protractor: Skill 4 Training O-Y Variation (%)

WT Protractor OY Variation			WT Protractor
Protractor movement whilst plotting measurement/measurement	Paper	O	5
		Y	12.5
Protractor movement whilst immobilizing	Paper	O	7.5
		Y	2.5
Slipping of protractor at vertex point pin (WT)	Paper	O	0
		Y	7.5
TDs not distinct enough	Plastic Sheet	O	2.5
		Y	7.692308
Protractor movement whilst plotting measurement/measurement	Thermoform	O	5
		Y	15

Table 7.35 Worth Trust Protractor: Skill 4 Test Key Issues (%)

		WT Protractor
Struggled in aligning protractor to vertex and Baseline	Paper Total	61.84211
	Plastic Sheet Total	44.73684
	Thermoform Total	50

	Grand Total	52.60417
Careless counting /Measuring Mistakes	Paper Total	15.78947
	Plastic Sheet Total	21.05263
	Thermoform Total	20
	Grand Total	18.75
Struggled in Placing the Protractor with right orientation	Paper Total	6.578947
	Plastic Sheet Total	13.15789
	Thermoform Total	12.5
	Grand Total	10.41667
Protractor movement whilst plotting measurement/measurement	Paper Total	6.578947
	Plastic Sheet Total	7.894737
	Thermoform Total	7.5
	Grand Total	7.291667
Slipping of protractor at vertex point pin (WT)	Paper Total	3.947368
	Plastic Sheet Total	10.52632
	Thermoform Total	0
	Grand Total	5.729167
Right by Fluke	Paper Total	6.578947

	Plastic Sheet Total	5.263158
	Thermoform Total	2.5
	Grand Total	5.208333
Pin/clip little off and guessing measure	Paper Total	5.263158
	Plastic Sheet Total	3.947368
	Thermoform Total	5
	Grand Total	4.6875
Errors/Difficulty in placing point pins on marked TDs/drawings (vertex/on arms)	Paper Total	6.578947
	Plastic Sheet Total	3.947368
	Thermoform Total	0
	Grand Total	4.166667
Aligning the wrong tip of the protractor to the vertex point	Paper Total	2.631579
	Plastic Sheet Total	3.947368
	Thermoform Total	7.5
	Grand Total	4.166667

Table 7.36 Worth Trust Protractor: Skill 4 Test O-Y Variation (%)

WT Protractor OY Variation			WT Protractor
Struggled in Placing the Protractor with right	Paper	Older	2.94117

orientation			6
		Younger	9.52381
Struggled in Placing the Protractor with right orientation	Thermoform	Older	5.263158
		Younger	19.04762
Protractor movement whilst plotting measurement/measurement	Plastic Sheet	Older	11.76471
		Younger	4.761905
Careless counting /Measuring Mistakes	Paper	Older	8.823529
		Younger	21.42857
Pin/clip little off and guessing measure	Paper	Older	8.823529
		Younger	2.380952
Right by Fluke	Plastic Sheet	Older	2.941176
		Younger	7.142857

Table 7.37 Protractor Cross Skill Questionnaire Objective Data (%)

	Easiest Protractor		Most Liked Protractor		Most Difficult Protractor		Least Liked Protractor	
Tools	Skill 3	Skill 4	Skill 3	Skill 4	Skill 3	Skill 4	Skill 3	Skill 4
APH Wand-inside	21.95122	NA	17.073	NA	19.048	NA	16.279	NA
APH Wand Outside	31.70732	25	21.951	15	9.5238	43.90244	13.953	28.571
Garg Protractor	21.95122	27.5	29.268	37.5	30.952	21.95122	11.628	23.81
RNIB Protractor	14.63415	22.5	7.3171	30	23.81	14.63415	23.256	19.048
WT Protractor	9.756098	25	24.39	17.5	16.667	17.07317	32.558	28.571

Table 7.38 Protractor Cross Skills Questionnaire Selected for Game (%)

Selected for Game Protractors		
Tools	Skill 3	Skill 4
APH Wand-inside	10	NA
APH Wand Outside	17.5	25
Garg Protractor	35	30
RNIB Protractor	2.5	27.5
WT Protractor	35	17.5

Table 7.39 Test Stage Results for Skill 3: Constructing an Angle (%)

Test Skill 3: Constructing an Angle										
	APH Wand-inside Protractor		APH Wand Protractor		Garg Protractor		RNIB Protractor	WT Protractor		
	Right	Wrong	Right	Wrong	Right	Wrong	Right	Wrong	Right	Wrong
APH Clip Ruler	0	0	0	0	0	0	32.5	67.5	37.5	62.5
None	25	75	32.5	67.5	50	50	0	0	0	0
RNIB Ruler	0	0	0	0	0	0	47.5	52.5	40	60
WT Ruler	0	0	0	0	0	0	55	45	37.5	62.5

Table 7.40 Test Stage Results for Skill 4: Measuring an Angle (%)

Test Skill 4: Measuring an Angle						
	Paper		Plastic Sheet		Thermoform	
Tool	Right	Wrong	Right	Wrong	Right	Wrong
APH Wand Outside Protractor	40	60	40	60	55	45
Garg Protractor	50	50	0	0	0	0
RNIB Protractor	75	25	52.5	47.5	57.5	42.5
WT Protractor	55.26316	44.73684	48.68421	51.31579	47.5	52.5

ANNEXURE M: DATA TABLES FOR CHAPTER 8**Table 8.1 APH Compass: Skill 5 Training Key Issues (%)**

		APH Compass Total
First Leg of compass coming off whilst drawing circle	APH Clip Ruler	0
	NA	57.5
	RNIB Ruler	0
	Squirrel Ruler	0
	Worth Trust Ruler	0
	Total	57.5
Drawing light and not neat	APH Clip Ruler	0
	NA	30
	RNIB Ruler	0
	Squirrel Ruler	0
	Worth Trust Ruler	0
	Total	30
Struggled reading marking on the compass	APH Clip Ruler	0
	NA	30
	RNIB Ruler	0
	Squirrel Ruler	0
	Worth Trust Ruler	0
	Total	30
Random counting mistakes	APH Clip Ruler	0
	NA	20
	RNIB Ruler	0
	Squirrel Ruler	0
	Worth Trust Ruler	0

	Total	20
Centre/ end point tears causing errors	APH Clip Ruler	0
	NA	12.5
	RNIB Ruler	0
	Squirrel Ruler	0
	Worth Trust Ruler	0
	Total	12.5
Paper folding and creasing whilst drawing	APH Clip Ruler	0
	NA	12.5
	RNIB Ruler	0
	Squirrel Ruler	0
	Worth Trust Ruler	0
	Total	12.5
Counting 1 as 0	APH Clip Ruler	0
	NA	12.5
	RNIB Ruler	0
	Squirrel Ruler	0
	Worth Trust Ruler	0
	Total	12.5
Difficulty locating centre of sheet to draw	APH Clip Ruler	0
	NA	7.5
	RNIB Ruler	0
	Squirrel Ruler	0
	Worth Trust Ruler	0
	Total	7.5

No OY Variation Skill 5 training

Table 8.2 APH Compass: Skill 5 Test Key Issues (%)

		APH Compass Total
First Leg of compass coming off whilst drawing circle	APH Clip Ruler	0
	NA	30
	RNIB Ruler	0
	Squirrel Ruler	0
	Worth Trust Ruler	0
	Total	30
Drawing light and not neat	APH Clip Ruler	0
	NA	27.5
	RNIB Ruler	0
	Squirrel Ruler	0
	Worth Trust Ruler	0
	Total	27.5
Difficulty in setting the second leg to the accurate measurement (includes Squirrel clip movement)	APH Clip Ruler	0
	NA	25
	RNIB Ruler	0
	Squirrel Ruler	0
	Worth Trust Ruler	0
	Total	25
Centre/ end point tears causing errors	APH Clip Ruler	0

	NA	17.5
	RNIB Ruler	0
	Squirrel Ruler	0
	Worth Trust Ruler	0
	Total	17.5
Difficulty locating centre of sheet to draw	APH Clip Ruler	0
	NA	10
	RNIB Ruler	0
	Squirrel Ruler	0
	Worth Trust Ruler	0
	Total	10
Random counting mistakes	APH Clip Ruler	0
	NA	10
	RNIB Ruler	0
	Squirrel Ruler	0
	Worth Trust Ruler	0
	Total	10
Not able to Maintain radius whilst drawing circle	APH Clip Ruler	0
	NA	10
	RNIB Ruler	0
	Squirrel Ruler	0
	Worth Trust	0

	Ruler	
	Total	10
Struggled reading marking on the compass	APH Clip Ruler	0
	NA	10
	RNIB Ruler	0
	Squirrel Ruler	0
	Worth Trust Ruler	0
	Total	10
Using wrong side of Ruler on the compass	APH Clip Ruler	0
	NA	7.5
	RNIB Ruler	0
	Squirrel Ruler	0
	Worth Trust Ruler	0
	Total	7.5
Counting 1 as 1	APH Clip Ruler	0
	NA	7.5
	RNIB Ruler	0
	Squirrel Ruler	0
	Worth Trust Ruler	0
	Total	7.5
Cannot be assessed	APH Clip Ruler	0
	NA	7.5
	RNIB Ruler	0

	Squirrel Ruler	0
	Worth Trust Ruler	0
	Total	7.5

Table 8.3 APH Compass: Skill 5 Test O-Y Variation (%)

APH Compass OY Variation		Older	Younger
Difficulty locating centre of sheet to draw	NA	5	15
Random counting mistakes	NA	15	5
Centre/ end point tears causing errors	NA	25	10
Struggled reading marking on the compass	NA	15	5

Table 8.4 APH Compass: Skill 6 Training Key Issues (%)

		APH Compass
Difficulty in identifying intersection points/Placement of pins off mark at intersection point	Grand Total	35
Placement of pins/first leg off mark at end points	Grand Total	20
First Leg of compass coming off whilst drawing arc	Grand Total	17.5
Stylus going away from ruler/line Marker whilst drawing	Grand Total	15
Drawing light and not neat (incomplete)	Grand Total	10
Not able to calculate radius measurement for setting arc	Grand Total	10
Arc drawn is not long enough to create an intersection point	Grand Total	10

Ruler /Line marker movement at drawing line bisector	Grand Total	10
Difficulty in identifying end points of line segments	Grand Total	7.5

Table 8.5 APH Compass: Skill 6 Training O-Y Variation (%)

		APH Compass
Leg of compass coming off whilst drawing arc	Older	25
	Younger	10
Not able to calculate radius measurement for setting arc	Older	0
	Younger	20
Difficulty in identifying end points of line segments	Older	5
	Younger	10
Arc drawn is not long enough to create an intersection point	Older	5
	Younger	15

Table 8.6 APH Compass: Skill 6 Test Key Issues (%)

	APH Compass
Placement of pins/first leg off mark at end points	37.5
Difficulty in identifying intersection points/Placement of pins off mark at intersection point	35
First Leg of compass coming off whilst drawing arc	20
Drawing light and not neat	20
Paper folding and creasing whilst drawing	20
Not able to judge radius for setting arc	15
Stylus going under the ruler/line marker	7.5
Ruler /Line marker movement at drawing line bisector (added to Skill 6)	7.5

Table 8.7 APH Compass: Skill 6 Test O-Y Variation (%)

APH Compass OY Variation		APH Compass
First Leg of compass coming off whilst drawing arc	Older	10
	Younger	30

Table 8.8 Classmates Compass: Skill 5 Training Key Issues (%)

		Classmate Compass Total
Not able to Maintain radius whilst drawing circle	APH Clip Ruler	55
	NA	0
	RNIB Ruler	40
	Squirrel Ruler	47.5
	Worth Trust Ruler	50
	Total	64.1666 7
First Leg of compass coming off whilst drawing circle	APH Clip Ruler	17.5
	NA	0
	RNIB Ruler	37.5
	Squirrel Ruler	22.5
	Worth Trust Ruler	30
	Total	35.8333 3
Drawing light and not neat	APH Clip Ruler	20
	NA	0
	RNIB Ruler	20
	Squirrel Ruler	15
	Worth	22.5

	Trust Ruler	
	Total	25.83333
Ruler movement whilst setting radius	APH Clip Ruler	37.5
	NA	0
	RNIB Ruler	7.5
	Squirrel Ruler	12.5
	Worth Trust Ruler	0
	Total	19.16667
First Leg of compass coming off whilst setting radius	APH Clip Ruler	7.5
	NA	0
	RNIB Ruler	15
	Squirrel Ruler	25
	Worth Trust Ruler	10
	Total	19.16667
Paper folding and creasing whilst drawing	APH Clip Ruler	5
	NA	0
	RNIB Ruler	12.5
	Squirrel Ruler	10
	Worth Trust	12.5

	Ruler	
	Total	13.3333 3
Not able to Maintain radius whilst setting radius itself	APH Clip Ruler	15
	NA	0
	RNIB Ruler	7.5
	Squirrel Ruler	7.5
	Worth Trust Ruler	7.5
	Total	12.5
Centre/ end point tears causing errors	APH Clip Ruler	7.5
	NA	0
	RNIB Ruler	17.5
	Squirrel Ruler	5
	Worth Trust Ruler	5
	Total	11.6666 7
Pen Coming off whilst drawing circle	APH Clip Ruler	7.5
	NA	0
	RNIB Ruler	10
	Squirrel Ruler	5
	Worth Trust Ruler	10
	Total	10.8333

		3
Struggled in Holding down Ruler with Compass whilst setting radius, leading to movement and errors	APH Clip Ruler	12.5
	NA	0
	RNIB Ruler	5
	Squirrel Ruler	5
	Worth Trust Ruler	5
	Total	9.166667
Pen Coming off whilst setting radius	APH Clip Ruler	7.5
	NA	0
	RNIB Ruler	5
	Squirrel Ruler	7.5
	Worth Trust Ruler	2.5
	Total	7.5
Difficulty locating centre of sheet to draw	APH Clip Ruler	2.5
	NA	0
	RNIB Ruler	0
	Squirrel Ruler	7.5
	Worth Trust Ruler	10
	Total	6.666667
Difficulty in using the knob on the compass	APH	5

	Clip Ruler	
	NA	0
	RNIB Ruler	5
	Squirrel Ruler	5
	Worth Trust Ruler	5
	Total	6.666667
Sheet tearing whilst drawing	APH Clip Ruler	7.5
	NA	0
	RNIB Ruler	5
	Squirrel Ruler	2.5
	Worth Trust Ruler	5
	Total	6.666667
Braille Reading Skill Limitations	APH Clip Ruler	0
	NA	0
	RNIB Ruler	0
	Squirrel Ruler	20
	Worth Trust Ruler	0
	Total	6.666667
First leg at 0.5 mark causing measurement errors	APH Clip	5

	Ruler	
	NA	0
	RNIB Ruler	0
	Squirrel Ruler	0
	Worth Trust Ruler	10
	Total	5

Table 8.9 Classmate Compass: Skill 5 Training O-Y Variation (%)

Classmate Compass OY Variation		Older	Younger
First leg at 0.5 mark causing measurement errors	Worth Trust Ruler	15	5
Ruler movement whilst setting radius	Squirrel Ruler	5	20
First Leg of compass coming off whilst setting radius	Worth Trust Ruler	15	5
First Leg of compass coming off whilst drawing circle	RNIB Ruler	20	55
	Worth Trust Ruler	15	45
Coming off whilst drawing circle	RNIB Ruler	0	20
	Worth Trust Ruler	15	5
Drawing light and not neat	Squirrel Ruler	20	10
	Worth Trust Ruler	15	30
Count of Centre/ end point tears causing errors	APH Clip Ruler	0	15
	RNIB Ruler	5	30
Not able to maintain radius whilst setting radius itself	APH Clip Ruler	20	10
	Squirrel Ruler	15	0

Table 8.10 Classmate Compass: Skill 5 Test Key Issues (%)

		Classmate Compass Total
Not able to maintain radius whilst drawing circle	APH Clip Ruler	50
	NA	0
	RNIB Ruler	50
	Squirrel Ruler	45
	Worth Trust Ruler	45
	Total	47.5
Difficulty in setting the second leg to the accurate measurement (includes Squirrel clip movement)	APH Clip Ruler	22.5
	NA	0
	RNIB Ruler	17.5
	Squirrel Ruler	40
	Worth Trust Ruler	20
	Total	25
Drawing light and not neat	APH Clip Ruler	22.5
	NA	0
	RNIB Ruler	25
	Squirrel Ruler	17.5
	Worth Trust Ruler	15
	Total	20
First Leg of compass coming off whilst drawing circle	APH Clip Ruler	27.5

	NA	0
	RNIB Ruler	17.5
	Squirrel Ruler	15
	Worth Trust Ruler	10
	Total	17.5
Random counting mistakes	APH Clip Ruler	15
	NA	0
	RNIB Ruler	15
	Squirrel Ruler	5
	Worth Trust Ruler	7.5
	Total	10.625
Difficulty in using the knob on the compass	APH Clip Ruler	10
	NA	0
	RNIB Ruler	17.5
	Squirrel Ruler	7.5
	Worth Trust Ruler	7.5
	Total	10.625
Paper folding and creasing whilst drawing	APH Clip Ruler	7.5
	NA	0
	RNIB Ruler	10
	Squirrel Ruler	15
	Worth Trust	5

	Ruler	
	Total	9.375
First leg at 0.5 mark causing measurement errors	APH Clip Ruler	10
	NA	0
	RNIB Ruler	7.5
	Squirrel Ruler	0
	Worth Trust Ruler	15
	Total	8.125
Ruler movement whilst setting radius	APH Clip Ruler	15
	NA	0
	RNIB Ruler	12.5
	Squirrel Ruler	2.5
	Worth Trust Ruler	2.5
	Total	8.125
Centre/ end point tears causing errors	APH Clip Ruler	7.5
	NA	0
	RNIB Ruler	7.5
	Squirrel Ruler	10
	Worth Trust Ruler	7.5
	Total	8.125
First Leg of compass coming off whilst setting radius	APH Clip Ruler	10
	NA	0
	RNIB Ruler	0

	Squirrel Ruler	10
	Worth Trust Ruler	10
	Total	7.5
Cannot be assessed	APH Clip Ruler	10
	NA	0
	RNIB Ruler	2.5
	Squirrel Ruler	10
	Worth Trust Ruler	5
	Total	6.875
Pen Coming off whilst drawing circle	APH Clip Ruler	5
	NA	0
	RNIB Ruler	7.5
	Squirrel Ruler	0
	Worth Trust Ruler	5
	Total	4.375
Counting 0 as 1	APH Clip Ruler	10
	NA	0
	RNIB Ruler	5
	Squirrel Ruler	2.5
	Worth Trust Ruler	0
	Total	4.375
Braille Reading Skill Limitations	APH Clip	2.5

	Ruler	
	NA	0
	RNIB Ruler	0
	Squirrel Ruler	12.5
	Worth Trust Ruler	0
	Total	3.75
Pen Coming off whilst setting radius	APH Clip Ruler	2.5
	NA	0
	RNIB Ruler	5
	Squirrel Ruler	0
	Worth Trust Ruler	5
	Total	3.125
Difficulty locating centre of sheet to draw	APH Clip Ruler	2.5
	NA	0
	RNIB Ruler	0
	Squirrel Ruler	5
	Worth Trust Ruler	2.5
	Total	2.5
Not able to maintain radius whilst setting radius itself	APH Clip Ruler	5
	NA	0
	RNIB Ruler	5
	Squirrel Ruler	0
	Worth	0

	Trust Ruler	
	Total	2.5

Table 8.11 Classmate Compass: Skill 5 Test O-Y Variation (%)

Classmate Compass OY Variation		Classmate Compass	
		Older	Younger
First leg at 0.5 mark causing measurement errors	RNIB Ruler	15	0
Random counting mistakes	APH Clip Ruler	10	20
Ruler movement whilst setting radius	APH Clip Ruler	25	5
Difficulty in using the knob on the compass	Squirrel Ruler	15	0
	Worth Trust Ruler	15	0
First Leg of compass coming off whilst drawing circle	Squirrel Ruler	10	20
Drawing light and not neat	Squirrel Ruler	30	5
	Worth Trust Ruler	15	15
Centre/ end point tears causing errors	APH Clip Ruler	0	15
	Worth Trust Ruler	0	15
Paper folding and creasing whilst drawing	RNIB Ruler	15	5
	Squirrel Ruler	5	25
Not able to maintain radius whilst drawing circle	Worth	30	60

	Trust Ruler		
Counting 0 as 1	APH Clip Ruler	5	15
<u>D</u> ifficulty in setting the second leg to the accurate measurement (includes squirrel clip movement)	APH Clip Ruler	15	30

Table 8.12 Classmates Compass: Skill 6 Training Key Issues (%)

		Classmate Compass
Difficulty in identifying intersection points/Placement of pins off mark at intersection point	Grand Total	57.5
Not able to maintain radius whilst drawing arc	Grand Total	40
Placement of pins/first leg off mark at end points	Grand Total	35
First Leg of compass coming off whilst drawing arc	Grand Total	17.5
Drawing light and not neat (incomplete)	Grand Total	15
Count of Difficulty in identifying end points of line segments	Grand Total	15
Centre/ end point tears causing errors	Grand Total	12.5
Stylus going away from ruler/line Marker whilst drawing	Grand Total	12.5
Not able to calculate radius measurement for setting arc	Grand Total	10
Sheet tearing whilst drawing	Grand Total	7.5
Paper folding and creasing whilst drawing	Grand Total	7.5
-Not able to judge radius for setting arc	Grand Total	7.5

Table 8.13 Classmate Compass: Skill 6 Training O-Y Variation (%)

		Classmate Compass
Drawing light and not neat (incomplete)	Older	20
	Young er	10
Centre/ end point tears causing errors	Older	0
	Young er	25
Sheet tearing whilst drawing	Older	0
	Young er	15
Not able to calculate radius measurement for setting arc	Older	0
	Young er	20
Difficulty in identifying end points of line segments	Older	10
	Young er	20
Difficulty in identifying intersection points/Placement of pins off mark at intersection point	Older	75
	Young er	40

Table 8.14 Classmate Compass: Skill 6 Test Key Issues (%)

	Classmate Compass
Difficulty in identifying intersection points/Placement of pins off mark at intersection point	62.5
Not able to maintain radius whilst drawing arc	47.5
Placement of pins/first leg off mark at end points	42.5
Drawing light and not neat	17.5
First Leg of compass coming off whilst drawing arc	15
Paper folding and creasing whilst drawing	12.5
Not able to judge radius for setting arc	12.5
Arc drawn is not long enough to create an intersection point	12.5
Stylus going under the ruler/line marker	12.5
Cannot be assessed	12.5
Pen Coming off whilst drawing arc	10
Difficulty in using the knob on the compass	7.5
Centre/ end point tears causing errors	7.5
Drawing arcs on outside end of line segments	7.5
Ruler /Line marker movement at drawing line bisector (added to Skill 6)	7.5

Table 8.15 Classmate Compass: Skill 6 Test O-Y Variation (%)

Classmate Compass OY Variation		Classmate Compass
Difficulty in using the knob on the compass	Older	15
	Younger	0
First Leg of compass coming off whilst drawing arc	Older	10
	Younger	20
Placement of pins/first leg off mark at end points	Older	55
	Younger	30
Ruler /Line marker movement at drawing line bisector (added to Skill 6)	Older	15
	Younger	0
Cannot be assessed	Older	5
	Younger	20

Table 8.16 Garg Compass: Skill 5 Training Key Issues (%)

		Garg Compass

		s Total
Struggled with Using stylus	APH Clip Ruler	0
	NA	37.5
	RNIB Ruler	0
	Squirrel Ruler	0
	Worth Trust Ruler	0
	Total	37.5
Drawing light and not neat	APH Clip Ruler	0
	NA	27.5
	RNIB Ruler	0
	Squirrel Ruler	0
	Worth Trust Ruler	0
	Total	27.5
Sheet tearing whilst drawing	APH Clip Ruler	0
	NA	27.5
	RNIB Ruler	0
	Squirrel Ruler	0
	Worth Trust Ruler	0
	Total	27.5
Braille Reading Skill Limitations	APH Clip Ruler	0
	NA	20
	RNIB Ruler	0
	Squirrel Ruler	0
	Worth Trust Ruler	0
	Total	20
Paper folding and creasing whilst drawing	APH Clip Ruler	0
	NA	7.5

	RNIB Ruler	0
	Squirrel Ruler	0
	Worth Trust Ruler	0
	Total	7.5
Point markers moving whilst drawing/ positioning arc/circle markers	APH Clip Ruler	0
	NA	5
	RNIB Ruler	0
	Squirrel Ruler	0
	Worth Trust Ruler	0
	Total	5

Table 8.17 Garg Compass: Skill 5 Training O-Y Variation (%)

		Garg Compass OY Variation	
		Older	Younger
Braille Reading Skill Limitations	NA	10	30

Table 8.18 Garg Compass: Skill 5 Test Key Issues (%)

		Garg Compass Total
Struggled with Using stylus	APH Clip Ruler	0
	NA	32.5
	RNIB Ruler	0
	Squirrel Ruler	0
	Worth Trust Ruler	0
	Total	32.5
Drawing light and not neat	APH Clip Ruler	0
	NA	20
	RNIB Ruler	0
	Squirrel Ruler	0
	Worth Trust Ruler	0
	Total	20
Paper folding and creasing whilst drawing	APH Clip Ruler	0
	NA	15
	RNIB Ruler	0
	Squirrel Ruler	0
	Worth Trust Ruler	0
	Total	15
Braille Reading Skill Limitations	APH Clip Ruler	0
	NA	10
	RNIB Ruler	0
	Squirrel Ruler	0
	Worth Trust Ruler	0

	Total	10
Difficulty locating centre of sheet to draw	APH Clip Ruler	0
	NA	7.5
	RNIB Ruler	0
	Squirrel Ruler	0
	Worth Trust Ruler	0
	Total	7.5
Sheet tearing whilst drawing	APH Clip Ruler	0
	NA	7.5
	RNIB Ruler	0
	Squirrel Ruler	0
	Worth Trust Ruler	0
	Total	7.5

Table 8.19 Garg Compass: Skill 5 Test O-Y Variation (%)

Garg Compass OY Variation		Older	Younger
Difficulty locating centre of sheet to draw	NA	0	15
Drawing light and not neat	NA	10	30
Sheet tearing whilst drawing	NA	15	0
Paper folding and creasing whilst drawing	NA	5	25

Table 8.20 Garg Compass: Skill 6 Training Key Issues (%)

		Garg Compass / Arc Compass
Difficulty in identifying intersection points/Placement of pins off mark at intersection point	Grand Total	40
Braille Reading Skill Limitations	Grand Total	35
Struggled with Using stylus	Grand Total	35
Point markers moving whilst drawing/ positioning arc/circle markers	Grand Total	32.5
Placement of pins/first leg off mark at end points	Grand Total	30
Circle/Arc markers not placed fully flat	Grand Total	27.5
Sheet tearing whilst drawing	Grand Total	25
Ruler /Line marker movement at drawing line bisector	Grand Total	25
Drawing over wrong arc markers	Grand Total	20
Drawing light and not neat (incomplete)	Grand Total	17.5
Centre/ end point tears causing errors	Grand Total	17.5

Not able to judge radius for setting arc	Grand Total	10
Drawing arcs on outside end of line segments	Grand Total	7.5
Arc drawn is not long enough to create an intersection point	Grand Total	7.5

Garg Compass: Skill 6 Training O-Y Variation NONE

Table 8.21 Garg Compass: Skill 6 Test Key Issues (%)

	Garg Compass / Arc Compass
Difficulty in identifying intersection points/Placement of pins off mark at intersection point	28.20513
Struggled with Using stylus	23.07692
Not able to calculate radius measurement for setting arc	20.51282
Placement of pins/first leg off mark at end points	20.51282
Drawing over wrong arc markers	20.51282
Cannot be assessed	20.51282
Point markers moving whilst drawing/ positioning arc/circle markers	17.94872
Ruler /Line marker movement at drawing line bisector (added to Skill 6)	17.94872
Drawing light and not neat	15.38462
Circle/Arc markers not placed fully flat	15.38462
Centre/ end point tears causing errors	7.692308
Sheet tearing whilst drawing	7.692308
Arc drawn is not long enough to create an intersection point	7.692308
Wrongly identifying intersection point on the line segment/ or end of arc	7.692308

Table 8.22 Garg Compass: Skill 6 Test O-Y Variation (%)

Garg Compass / Arc Compass OY Variation		Garg Compass / Arc Compass
Drawing light and not neat	Older	10.52631579
	Younger	20
Arc drawn is not long enough to create an intersection point	Older	0
	Younger	15
Circle/Arc markers not placed fully flat	Older	10.52631579
	Younger	20
Cannot be assessed	Older	10.52631579
	Younger	30

Table 8.23 Worth Trust Compass: Skill 5 Training Key Issues (%)

		Worth Trust ruler as a compass Total
Drawing light and not neat	APH Clip Ruler	0
	NA	35
	RNIB Ruler	0
	Squirrel Ruler	0
	Worth Trust Ruler	0
	Total	35
Sheet tearing whilst drawing	APH Clip Ruler	0
	NA	20
	RNIB Ruler	0
	Squirrel Ruler	0
	Worth Trust Ruler	0
	Total	20
Struggled with Using stylus	APH Clip Ruler	0
	NA	15
	RNIB Ruler	0
	Squirrel Ruler	0
	Worth Trust Ruler	0
	Total	15
Difficulty locating centre of sheet to draw	APH Clip Ruler	0
	NA	12.5
	RNIB Ruler	0
	Squirrel Ruler	0
	Worth Trust Ruler	0
	Total	12.5
Paper folding and creasing whilst drawing	APH Clip Ruler	0
	NA	10
	RNIB Ruler	0
	Squirrel Ruler	0
	Worth Trust	0

	Ruler	
	Total	10
First Leg of compass coming off whilst drawing circle	APH Clip Ruler	0
	NA	7.5
	RNIB Ruler	0
	Squirrel Ruler	0
	Worth Trust Ruler	0
	Total	7.5
Not able to maintain radius whilst drawing circle	APH Clip Ruler	0
	NA	7.5
	RNIB Ruler	0
	Squirrel Ruler	0
	Worth Trust Ruler	0
	Total	7.5

Table 8.24 Worth Trust Compass: Skill 5 Training O-Y Variation (%)

		Worth Trust ruler as a compass OY Variation	
		Older	Younger
Paper folding and creasing whilst drawing	NA	5	15

Table 8.25 Worth Trust Compass: Skill 5 Test Key Issues (%)

		Worth Trust ruler as a compass Total
Drawing light and not neat	APH Clip Ruler	0
	NA	25
	RNIB Ruler	0
	Squirrel Ruler	0
	Worth Trust Ruler	0
	Total	25

Paper folding and creasing whilst drawing	APH Clip Ruler	0
	NA	20
	RNIB Ruler	0
	Squirrel Ruler	0
	Worth Trust Ruler	0
	Total	20
Immobilization pins/clips coming in the way of drawing	APH Clip Ruler	0
	NA	15
	RNIB Ruler	0
	Squirrel Ruler	0
	Worth Trust Ruler	0
	Total	15
Not able to maintain radius whilst drawing circle	APH Clip Ruler	0
	NA	10
	RNIB Ruler	0
	Squirrel Ruler	0
	Worth Trust Ruler	0
	Total	10
Struggled with Using stylus	APH Clip Ruler	0
	NA	10
	RNIB Ruler	0
	Squirrel Ruler	0
	Worth Trust Ruler	0
	Total	10
First Leg of compass coming off whilst drawing circle	APH Clip Ruler	0
	NA	7.5
	RNIB Ruler	0
	Squirrel Ruler	0
	Worth Trust Ruler	0
	Total	7.5
Centre/ end point tears causing errors	APH Clip Ruler	0
	NA	7.5
	RNIB Ruler	0
	Squirrel Ruler	0

	Worth Trust Ruler	0
	Total	7.5
Difficulty Placing 1st pins in 1st hole of WT Ruler	APH Clip Ruler	0
	NA	7.5
	RNIB Ruler	0
	Squirrel Ruler	0
	Worth Trust Ruler	0
	Total	7.5

Table 8.26 Worth Trust Compass: Skill 5 Test O-Y Variation (%)

Worth Trust ruler as a compass Total OY Variation		Older	Younger
First Leg of compass coming off whilst drawing circle	NA	5	10
Centre/ end point tears causing erros	NA	5	10
Immobilization pins/clips coming in the way of drawing	NA	10	20
Struggled with Using stylus	NA	15	5
Difficulty Placing 1st pins in 1st hole of WT Ruler	NA	10	5

Table 8.27 Worth Trust Compass: Skill 6 Training Key Issues (%)

		Worth Trust Ruler Compass
Difficulty in identifying intersection points/Placement of pins off mark at intersection point	Grand Total	50
Placement of pins/first leg off mark at end points	Grand Total	40
Drawing light and not neat (incomplete)	Grand Total	25
Sheet tearing whilst drawing	Grand Total	25
Immobilization pins/clips coming in the way of drawing	Grand Total	25
Struggled with Using stylus	Grand Total	20
Stylus going away from ruler/line Marker whilst drawing	Grand Total	17.5
Paper folding and creasing whilst drawing	Grand Total	15
Not able to calculate radius measurement for setting arc	Grand Total	12.5
Difficulty in identifying end points of line segments	Grand Total	12.5
Random counting mistakes	Grand Total	10
Drawing arcs on outside end of line segments	Grand Total	10
Not able to judge radius for setting arc	Grand Total	7.5
Stylus going off whilst drawing leading to errors when being placed back whilst drawing	Grand Total	7.5
Difficulty in setting the second leg to the accurate measurement	Grand Total	7.5
Difficulty Placing 1st pins in 1st hole of WT Ruler	Grand Total	7.5

Table 8.28 Worth Trust Compass: Skill 6 Training O-Y Variation (%)

		Worth Trust Ruler Compass
Drawing light and not neat (incomplete)	Older	15
	Young er	35
Sheet tearing whilst drawing	Older	15
	Young er	35
Immobilization pins/clips coming in the way of drawing	Older	35
	Young er	15
Not able to judge radius for setting arc	Older	15
	Young er	0
Stylus going away from ruler/line Marker whilst drawing	Older	25
	Young er	10

Table 8.29 Worth Trust Compass: Skill 6 Test Key Issues (%)

Placement of pins/first leg off mark at end points
Difficulty in identifying intersection points/Placement of pins off mark at intersection point
Drawing light and not neat
Cannot be assessed
Immobilization pins/clips coming in the way of drawing
Not able to calculate radius measurement for setting arc
Arc drawn is not long enough to create an intersection point
Struggled with Using stylus
Ruler /Line marker movement at drawing line bisector (added to Skill 6)
Paper folding and creasing whilst drawing
Random counting mistakes
Sheet tearing whilst drawing
Wrongly identifying intersection point on the line segment/or end of arc
Stylus going off whilst drawing leading to errors when being placed back whilst drawing

Table 8.30.Worth Trust Compass: Skill 6 Test O-Y Variation (%)

Worth Trust Ruler Compass OY Variation		Worth Trust Ruler Compass
Paper folding and creasing whilst drawing	Older	5
	Younger	15
Struggled with Using stylus	Older	20
	Younger	10
Ruler /Line marker movement at drawing line bisector (added to Skill 6)	Older	10
	Younger	20
Cannot be assessed	Older	15
	Younger	30

Table 8.31.Compass Cross Skills Questionnaire Objective Data (%)

	Easiest Compass		Most Liked Compass		Most Difficult Compass		Least Liked Compass	
Tools	Skill 5	Skill 6	Skill 5	Skill 6	Skill 5	Skill 6	Skill 5	Skill 6
APH Comp ass	30	45	36.585	34.884	20	12.5	12.195	22.5
Class mate Comp ass	10	12.5	4.878	13.953	45	37.5	53.659	35
Garg Comp ass	32.5	22.5	36.585	23.256	22.5	30	17.073	25
Worth Trust Ruler as a Comp ass	27.5	20	21.951	27.907	10	17.5	17.073	17.5

Table 8.32 Compass Cross Skills Questionnaire Selected for Game (%)

Selected for Game Compass		
Tools	Skill 5	Skill 6
APH Compass	22.5	40
Classmate Compass	5	12.5
Garg Compass	50	32.5
Worth Trust Ruler as a Compass	22.5	15

Table 8.33 Test Stage Results for Skill 5: Constructing a Circle (%)

Test Skill 5: Constructing a Circle								
	APH Compass		Classmate Compass		Garg Compass		Worth Trust ruler as a compass	
	Right	Wrong	Right	Wrong	Right	Wrong	Right	Wrong
APH Clip Ruler	0	0	10	90	0	0	0	0
NA	42.5	57.5	0	0	90	10	65	35
RNIB Ruler	0	0	22.5	77.5	0	0	0	0
Squirre I Ruler	0	0	25	75	0	0	0	0
Worth Trust Ruler	0	0	27.5	72.5	0	0	0	0

Table 8.34 Test Stage Results for Skill 6: Constructing/Cutting Arcs (%)

	Right	Wrong
APH Compass	50	50
Classmate Compass	30	70
Garg Compass / Arc Compass	43.58974	56.41026
Worth Trust Ruler Compass	30	70

ANNEXURE N: DATA TABLES FOR CHAPTER 9**Table 9.1 Sheet Cross Skill Questionnaire Objective Data (%)**

	Easiest Sheet		Most Liked Sheet		Most Difficult Sheet		Least Liked Sheet	
Sheet s	Skill 2	Skill 4	Skill 2	Skill 4	Skill 2	Skill 4	Skill 2	Skill 4
Paper	21.95 122	11.90 476	14.28 571	15	25	27.5	29.2 682 9	29.2 683
Plastic Sheet	9.756 098	11.90 476	11.90 476	5	70	62.5	60.9 756 1	65.8 537
Thermoform	68.29 268	76.19 048	73.80 952	80	2.5	7.5	9.75 609 8	4.87 805

Table 9.2. Sheet Cross Skills Questionnaire Selected for Game (%)

Selected for Game Sheet		
Sheets	Skill 2	Skill 4
Braille Paper	17.5	40
Plastic Sheet	15	10
Thermoform	67.5	50

Table 9.3 Board Cross Skill Questionnaire Objective Data (%)

	Easiest Board	Most Liked Board	Most Difficult Board	Least Liked Board
Tools	Skill 1	Skill 1	Skill 1	Skill 1
Draftsman Board	41.46341	48.78049	25	22.5
Exam Board	34.14634	24.39024	20	32.5
Garg Board	24.39024	26.82927	55	45

Table 9.4 Board Cross-skill Questionnaire Selected for Game

Selected for Game Board	
Tools	Skill 1
Draftsman Board	22.5
Exam Board	57.5
Garg Board	20