

# Deaf TEC

Technological Education Center for  
Deaf and Hard-of-Hearing Students

## Deaf Students in the Mathematics Classroom: Ideas for Instruction

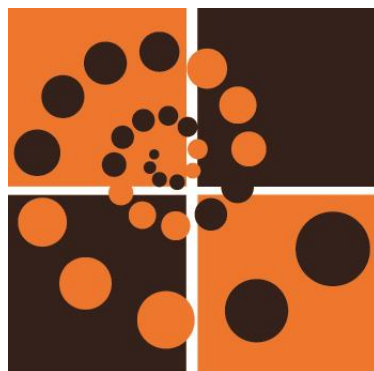
*Dawn Hoyt Kidd*

*Gary Blatto-Vallee*

*Carol Marchetti*



This material is based on work supported by the National Science Foundation under grant number DUE 1104229. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the NSF.



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## Math with a Little (Lot of) Language Thrown In

*Dawn Hoyt Kidd, Ph. D.*

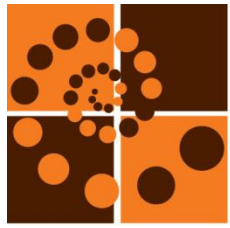
*National Council of Teachers of Mathematics*

*New Orleans, LA*

*April 2014*



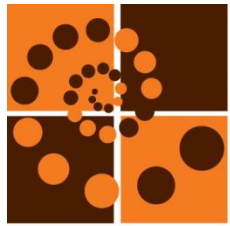
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# DeafTEC

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DeafTEC provides resources for high schools and community colleges that educate deaf and hard-of-hearing students in STEM-related programs.



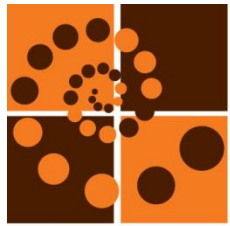
# DeafTEC

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Goal:

More Deaf and Hard of Hearing  
students  
going into  
**S T E M** fields.

[deaftec.org](http://deaftec.org)



# DeafTEC

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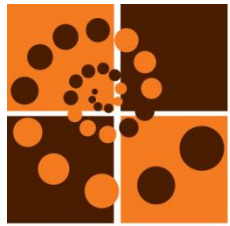
- **STEM - MATHEMATICS**
- **Communication:**
  - Reading, Writing, Talking, Signing, Looking, Listening, etc.
- **Problem Solving**
  - Applying, Analyzing, Questioning, Troubleshooting, etc.

## Discussion

*Word Problem Analysis Form*

*DeafTEC Math Resources*





# Deaf TEC

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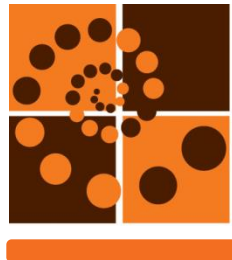
Mrs. Nevin is making a costume for a school play. She needs a piece of fabric that is greater than  $\frac{1}{2}$  of a yard but less than  $\frac{5}{8}$  of a yard. Which length of fabric listed below could she use?

**F**  $\frac{3}{8}$  yard

**G**  $\frac{4}{7}$  yard

**H**  $\frac{3}{7}$  yard

**J**  $\frac{2}{4}$  yard



Name: \_\_\_\_\_

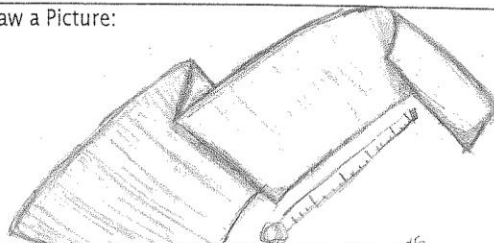
Problem Name/Number: <u>6</u>		Today's Date: <u>7/5/13</u>
Who? <u>Mrs. No. 1</u>	What? <u>Costume</u>	Important numbers: $\frac{1}{2}$ $\frac{5}{8}$
Where?	When?	

(Cross out any unimportant numbers)

Question: (rewrite the question)

Which length of fabric list below could she use?

Draw a Picture:



Computation (show ALL of your math):

F:  $\frac{3}{8} = .375$

G:  $\frac{4}{7} = .571$

H:  $\frac{2}{3} = .428$

J:  $\frac{7}{9} = .777$

Handwritten math work showing long division for  $\frac{4}{7}$  and  $\frac{2}{3}$ , and a STAAR chart.

STAAR Chart:

+	-	<del>X</del>	<del>÷</del>
---	---	--------------	--------------

Which operations did you use?  +    -    X    ÷

Write what you did (use English sentences!):

First I ... just used numerator divid by decmitor...

Did you use the STAAR chart? NO

(Write the formula you used)

My Brain!

Is your answer

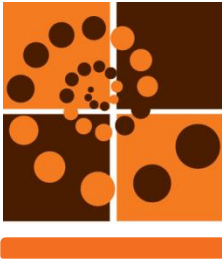
"Reasonable"?

$\frac{4}{7}$       $\frac{5}{8}$   
 $\frac{4}{7} = .571$


FINAL ANSWER:

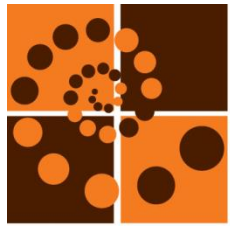
G:  $\frac{4}{7}$ !





Name: \_\_\_\_\_

Problem Name/Number: <u>6</u>		Today's Date: <u>9/5/13</u>
Who? <u>Mrs. Nevin</u>	What? <u>making costumes</u>	Important numbers: <u><math>\frac{1}{2}</math> <math>\frac{5}{8}</math></u>
Where? <u>School Play</u>	When? <u>?</u>	(Cross out any unimportant numbers)
Question: (rewrite the question) <u>Mrs. Nevin is making a costume for a school play. She needs a piece of fabric that is greater than <math>\frac{1}{2}</math> of a yard but less than <math>\frac{5}{8}</math> of a yard. Which length of fabric listed below could she use?</u>		
Draw a Picture: 		
Computation (show ALL of your math): $\frac{3}{7}$ $\frac{1}{2} = 0.5 = 50\%$ $\frac{3}{8} = 0.375 \rightarrow 37.5\%$ $\frac{4}{7} = 0.57159718$ $\frac{0.625}{8} \rightarrow 0.078125$ $8 \overline{) 13.0}$ $7 \overline{) 4.000}$ $\frac{30}{40}$ $\frac{40}{40}$ $\frac{50}{49}$ Which operations did you use? <input type="checkbox"/> + <input type="checkbox"/> - <input type="checkbox"/> x <input checked="" type="checkbox"/> $\div$		
Write what you did (use English sentences!): <u>First I... divide fraction into decimal then percent and use it on <math>\frac{1}{2}</math>, <math>\frac{5}{8}</math>, <math>\frac{3}{8}</math>, <math>\frac{4}{7}</math>, and <math>\frac{3}{4}</math> too then find percent in between of <math>\frac{1}{2}</math> and <math>\frac{5}{8}</math></u>		
Did you use the STAAR chart? <u>NO</u> (Write the formula you used)	Is your answer "Reasonable"? <u>YES</u>	
FINAL ANSWER: <u><math>\frac{4}{7}</math></u>		



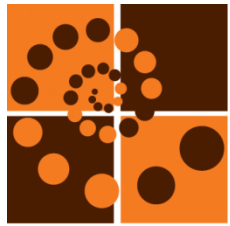
# DeafTEC

## Resources

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- DeafTEC web site: [deaftec.org](http://deaftec.org)
- EDeafMath Blog [edeafmath.blogspot.com](http://edeafmath.blogspot.com)
- FaceBook page [“EDeafMath”](#)
- Kidd website [kiddmathtsd.weebly.com](http://kiddmathtsd.weebly.com)

dawn.kidd@tsd.state.tx.us



# DeafTEC

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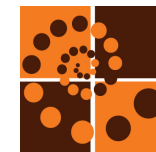
## On-Line Mathematics Video Resources for Deaf and Hard of Hearing Students

Gary Blatto-Vallee

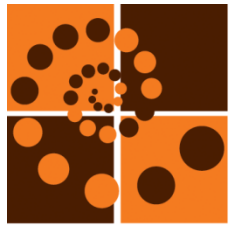
Mathematics Lecturer Department of Science and  
Mathematics NTID



**DeafTEC is supported by the National  
Science Foundation under award  
number DUE -1104229**



**DeafTEC**  
Technological Education Center for  
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# DeafTEC

# DeafTEC: Math Resource Section



## DeafTEC

[▼ Projects and Programs](#) [▼ Resources](#) [▼ Workshops](#) [▼ About DeafTEC](#)

[Home](#) >

## Resources

### RESOURCES

[Best Practices for Teaching \(ClassACT\)](#)

[Employer Resources](#)

[English Resources](#)

#### Math Resources

[Math Self-Instruction Modules](#)

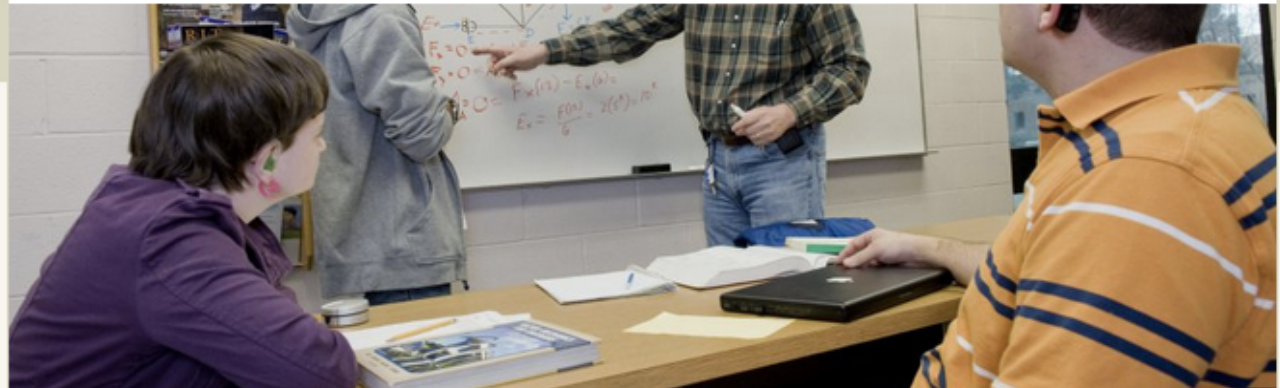
[Teaching Math to Deaf Students](#)

[Best Practices Blog](#)

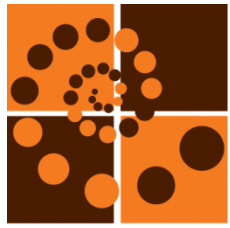
[Using Cooperative Learning Groups](#)

[STEM Careers](#)

## Math Resources



Explore this section via the links at left.



# Deaf TEC

## International and Consistent

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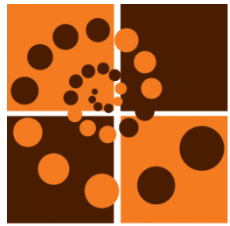
- Mathematical gap is not unique to the United States it has been noted in Norway and Japan as well (Frostad & Ahlberg 1999, Phelps & Branyon 1990).
- Deaf Children neither fall further behind nor catch up to their hearing counter parts as they progress through school (Nunes & Moreno 1998).



# DeafTEC Deafness is not the cause

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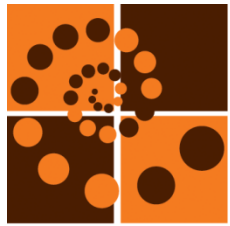
- Nunes and Moreno (1998) argue that deafness is not a cause for difficulties in mathematics and cite research that shows that in fact deafness accounts for very little of the variance in mathematical achievement.
- The fact that 15% profoundly deaf individuals perform at or above average levels in mathematics achievement tests (Wollman 1965, Wood 1983) supports this argument.



# DeafTEC Intervention

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- Nunes and Moreno (2002) designed an Intervention program
- Focus on informal mathematics skills
  - additive composition
  - additive reasoning
  - multiplicative reasoning
  - ratio and fractions



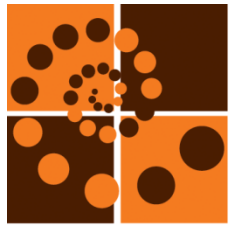
# Deaf TEC

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- Khan Academy
- Live Video Tutoring proposal



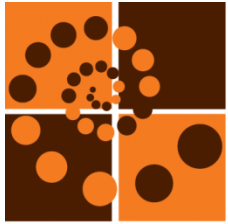




# Deaf TEC

- Resources created for hearing students
- Resources created for Deaf Students





# Deaf TEC

So... Why not eat at the buffet?

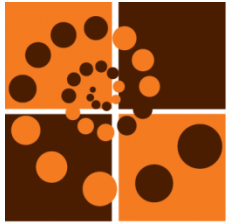
Sum of two numbers is 70. They  
differ by 11. What are the numbers?

Let  $x$  be larger number  
 $y$  be smaller number

$$\begin{array}{r} x + y = 70 \\ x - y = 11 \\ \hline x = y + 11 \end{array}$$
$$(y + 11) + y = 70$$

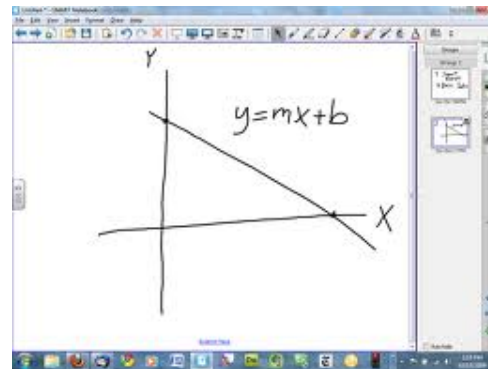
(( tells us all for life ))

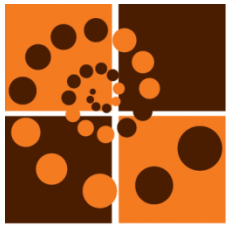
it actually said "solve for y"



# DeafTEC

- Camtasia
- Wacom Tablet
- Whiteboard Software
  - Smart Board
  - Open Sankore
  - Paint (PC)





# Deaf TEC

How it looks....


Handwritten math on a whiteboard:

$$\begin{array}{r} 5x - 4 = 11 \\ +4 \quad +4 \\ \hline 5x = 15 \\ \frac{5x}{5} = \frac{15}{5} \\ \boxed{x = 3} \end{array}$$

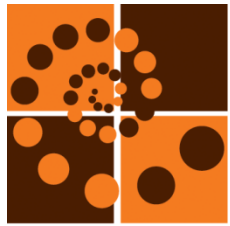
1.  $y = x - 2$  find  $y$   
 $y = 3 - 2$   
 $y = 1$   
Answer:  $(3, 1)$

3. Solve for the variable in the new Equation

4. use the answer in either of the original Equations to find the other variable's value.



We need to check the answer.



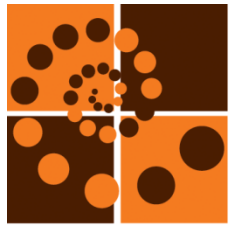
# DeafTEC

## Video Resources... How it all works together

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[www.DeafTEC.org](http://www.DeafTEC.org)

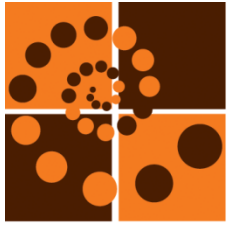
[www.khanacademy.org](http://www.khanacademy.org)



# Deaf TEC

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- <http://deaftec.org/resources/math/self-instruction>

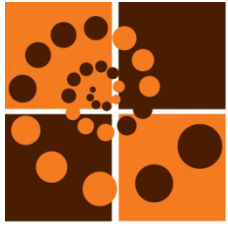


Q: How helpful are the “flipped classroom” style video lectures?

**Helpful:** “when you use at home... It makes me relax and thinking better, in better way to learn”

**Helpful:** “hard to take notes”

**Not Helpful/Helpful:** “It’s helpful to have the video/notes handy but it’s best to have hands on in class”



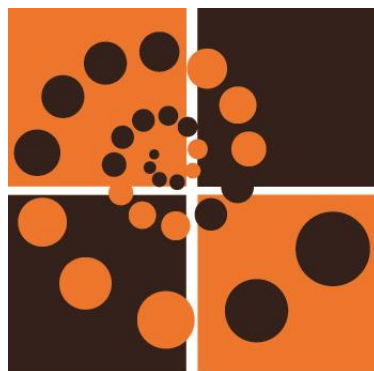
# Deaf TEC

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## Who can benefit?

- Teachers in Schools for the Deaf
- Itinerant Teachers
- D/HH Students
- Interpreters in Educational settings
- Interpreter Training Programs
- Parents of D/HH Students
- D/HH Parents of Hearing Children
- Deaf and Hard of Hearing Adult Learners
- Mainstream Teachers (all teachers)
- Second language learners
- Students with varied learning styles





# Deaf TEC

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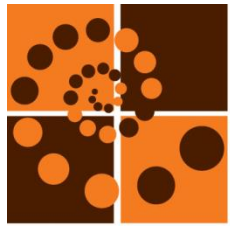
## Facilitating Cooperative Learning in Student Workgroups

*Carol Marchetti*

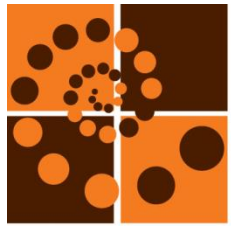
*National Council of Teachers of Mathematics, New Orleans, LA*



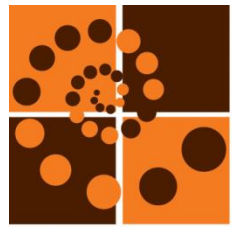
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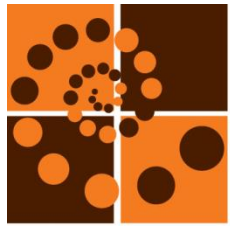
- 
- Susan Foster, Ph.D. in Special Education
  - Gary Long, Ph.D. in Experimental Psychology
  - Carol Marchetti, Ph.D. in Statistics
  - Michael Stinson, Ph.D. in Educational Psychology
  - Steve Singer, Ed.M., Ph.D. Student in Education and Disabilities Studies
  - Jonathan Furman, MS student in Deaf Education
  - AJ Krebs, MS student in Deaf Education



- Small groups work together on structured activity
- Students active and engaged
- More advanced students often assist less advanced students
- Cooperative learning has been shown to promote
  - Analytical skills
  - Deep meaningful learning

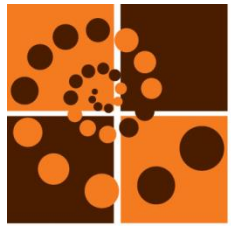


- Increased use of small group, cooperative learning
  - At all levels of education
  - In STEM disciplines in higher education
- Next Generation Science Standards (NGSS) emphasize participation in small groups for secondary students
- President's Council of Advisors on Science & Technology (PCAST) recommends active learning to enhance retention of STEM majors



## For Mixed Hearing Statuses within a Group

- **Direct Communication**
  - Students often prefer direct communication with peers, but may not understand each other's speech / signing
  - Communication and task completion often slower
- **Access Services (Interpreter, Captionist)**
  - Lag due to service processing time frequently limits D/HH students' participation
  - Access service provider may not be readily available to aid in-group communication\*



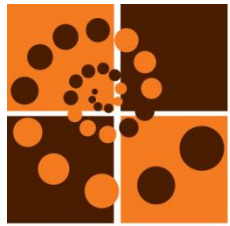
## Beyond Communication Challenges

- Notes: D/HH students may rely on notetaker - notes not available until after class.

### ➤ Results

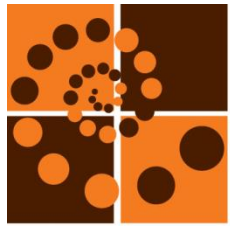
- Not all group members participate
- Not all group members understand





- Communication Tool = Whiteboards
  - One large whiteboard per group (40x72)
  - Space for written communication and showing work
  - Place to post assignment

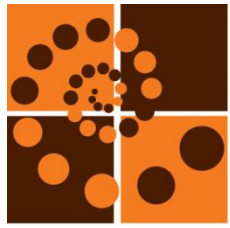




## Considerations To Enhance Cooperative Learning

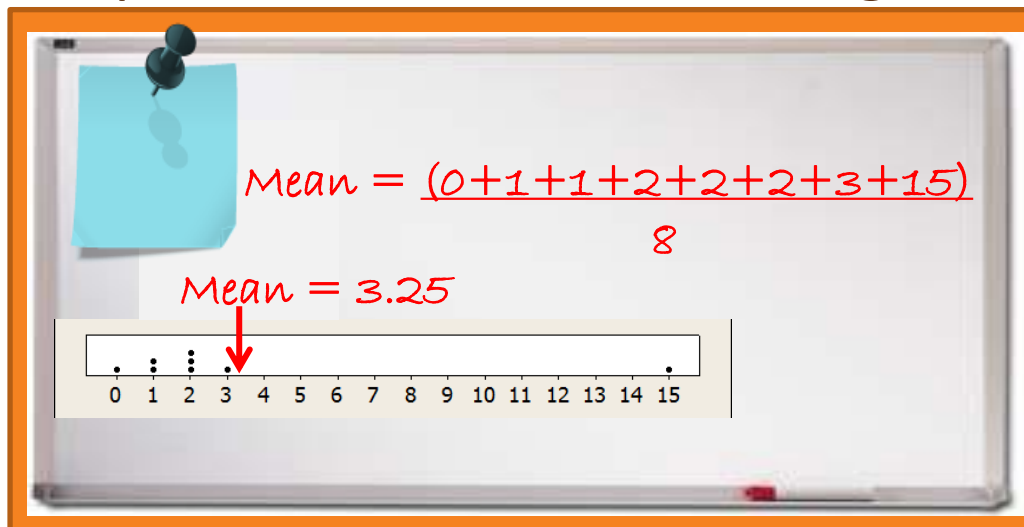
- Design of Activity/Assignment
- Classroom Environment
- Group Dynamics
- Behavior
  - Expectations and Examples





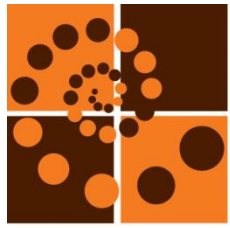
## Promote Collaboration

- One worksheet per group
- Written instructions within the assignment to use the whiteboard to jot ideas, draw pictures, etc.
- "Checkpoints" for understanding

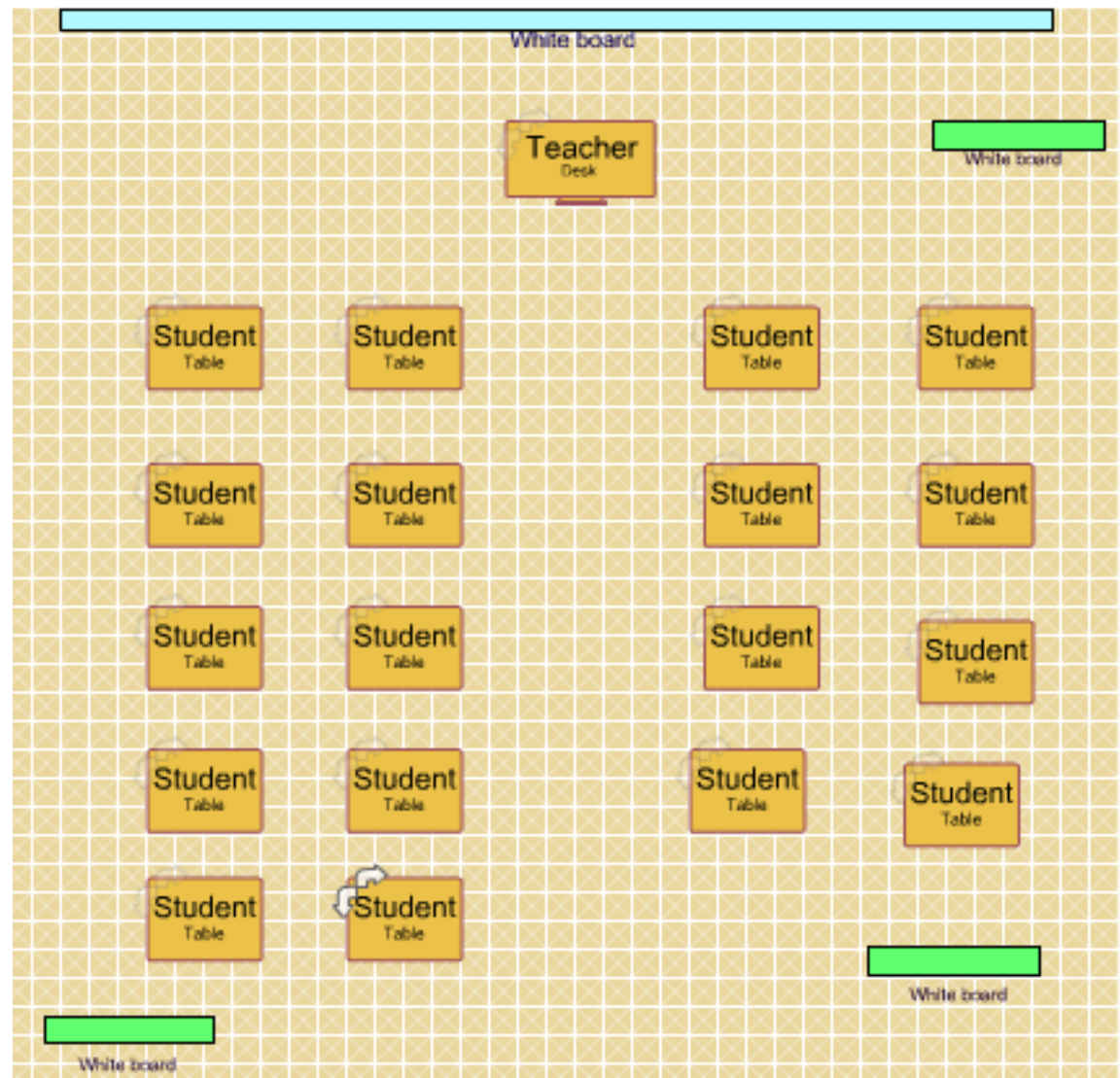


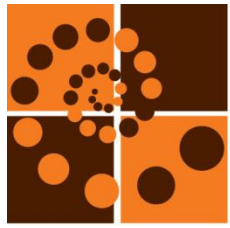
Compute the mean and add it to the dotplot. Why is it not in the center of the values?

✓ **Checkpoint**



- Is there sufficient and appropriate space to work?

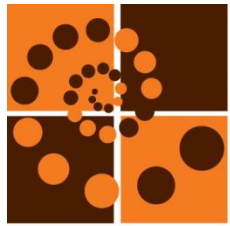




## Address Group Dynamics

- Deaf Experience
  - Video and Debrief
- Ground Rules
  - Groups set their own ground rules
- Feedback
  - Students to provide feedback to instructor
- Learning Cycles
  - Groups reflect on successes & challenges
  - Develop strategies to improve





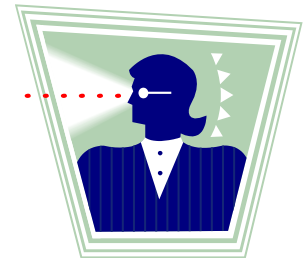
## Set Expectations

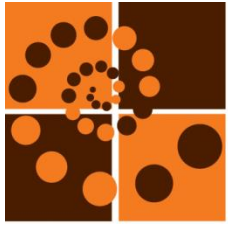
- Each member enhances the group
  - Create space so that everyone is able to contribute
  - You are accountable to your group



## Model Good Behavior

- Ensure line of sight for all before speaking
- Wait after writing on board before speaking
- Taking turns
- Explain!

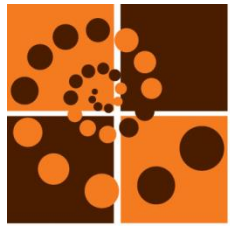




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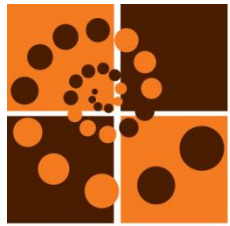
Student group using whiteboard in class for communication and showing work.



# DeafTEC

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- Resources: [deaftec.org](http://deaftec.org)
  - Deaf Experience Video
  - Group Guidelines and Roles
  - Ground Rules Assignment
  - Member Feedback Form
  - Learning Cycle Assignment
- Questions?
- Sharing – challenges and strategies



# DeafTEC

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- Contact Information

- Dawn Kidd: [dawn.kidd@tsd.state.tx.us](mailto:dawn.kidd@tsd.state.tx.us)

- Gary Blatto-Vallee: [gcbntm@rit.edu](mailto:gcbntm@rit.edu)

- Carol Marchetti: [cemsma@rit.edu](mailto:cemsma@rit.edu)

- DeafTec.org

