

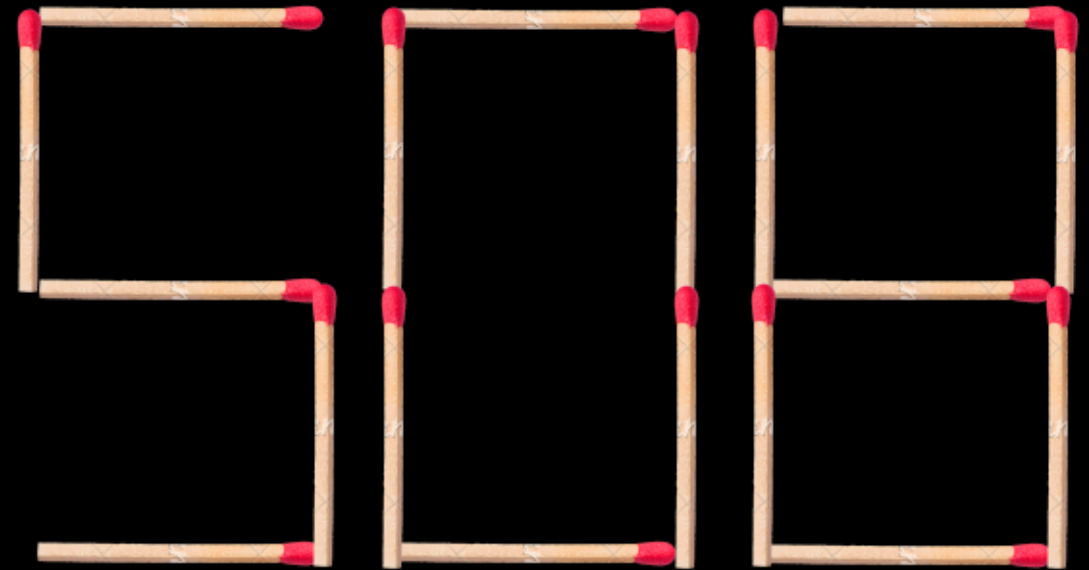
## Preparing for teaching

### Goals:

- *Obtain and share ideas for planning teaching*
- *Learn some conversation techniques*

Hilja Lisa Huru og Øistein Søvik, UiT

## Problem of the day



**If you can only move two matches, what is the biggest possible number?**

A horizontal band of dark blue watercolor paint, with some lighter blue and white areas visible at the top and bottom edges, suggesting a brushstroke or a torn paper effect. The word "Preparing" is written in white, sans-serif font, centered within the blue band.

Preparing

Assume you as a TA is asked to step in at 10 for someone sick to hold a "seminar" / "gruppetime".

Tuesday 09:58

Yo, Øistein Det har blitt en stor misforståelse med kræsjkurset i flerdim som e i dag kl 4, så vi har ingen te å hold kurset.. Har du tid å lyst te å gå gjennom en eksamen ellns?



Seff!

**Think, pair, share:**

- **Spend 2 minutes alone thinking**
- **Discuss in groups**
- **Share in chat**

# Constructive Alignment



*There should be logical alignment between all three elements - it does not matter where the design point starts. (Adapted from Biggs, 2003)*

Current Results

Where the  
learners are.

Desired Results

Where they  
need to be.

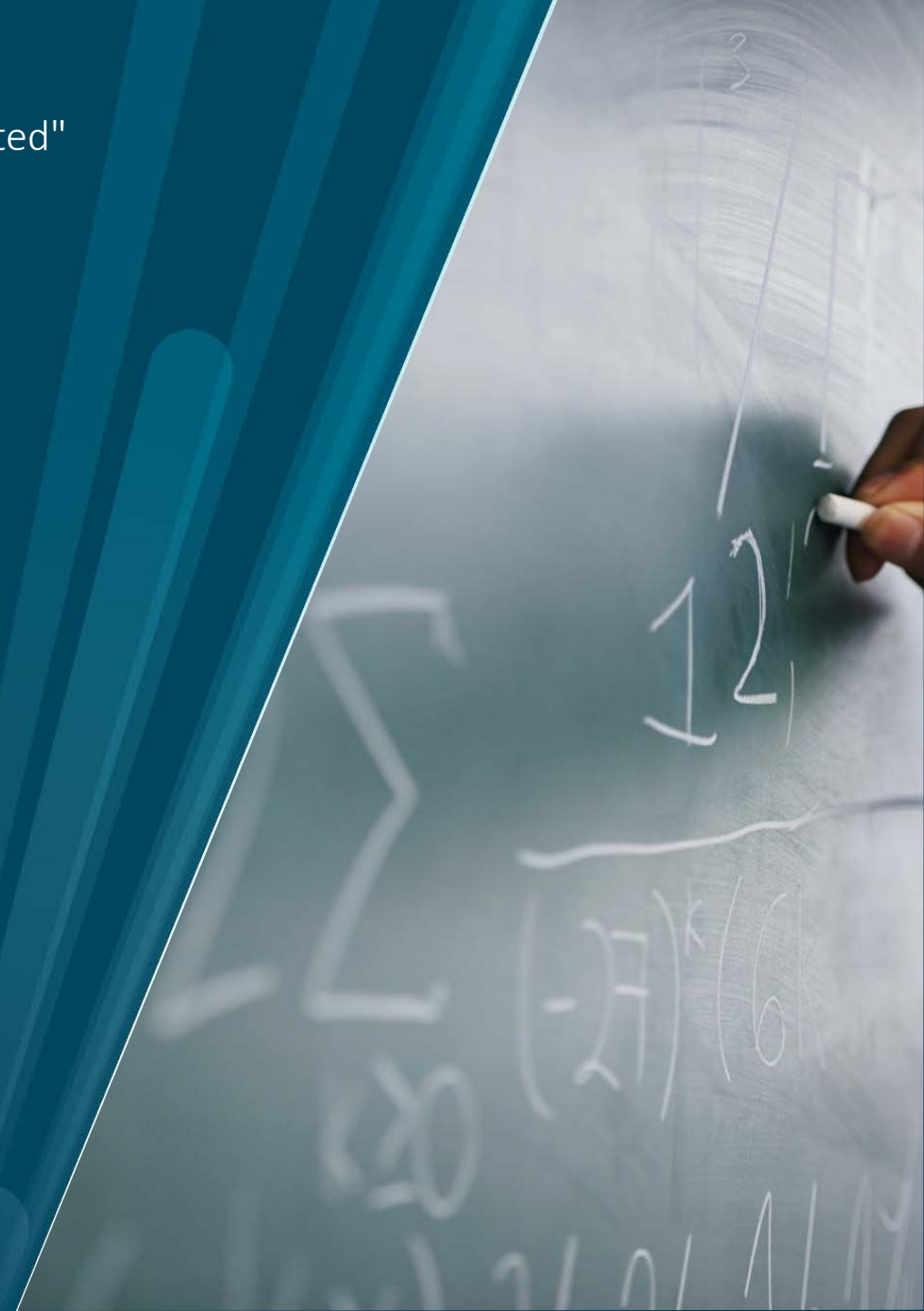


How do you  
fill this gap?

1. **Identify the learning outcomes.** What should the students learn from these exercises? (Kompetansemål)
2. **Solve** *only* the problems you do not know how to solve.
3. **Identify problems** or topics that could be difficult for the students to understand.
4. **Plan out** how you will explain the problems above. Try to view the problem from the student's perspective, what is expected of them to know?

**Remember:** whether you can solve the problems is somewhat irrelevant! What *is* important is whether you can teach the students how to solve the problems themselves!

**Do** spend time preparing. **Don't** spend time solving every exercise.





## Tips and tricks for preparing for seminars.

- **Begin with the end.** Clearly define what you want your students to have learned or understood after the session.
- **Post it:** Either write it on the blackboard or orally convey to the students what you want them to learn. One sentence ^^
- **Understand the concept:** Beforehand see that you understand the overarching concepts of the session. How would you explain the general themes / concepts?
- **Measure:** Plan how you will assess if the students have learned what you want them to.
- **Engage the students:** Plan good questions to make the students discuss in groups. Problem of the day.



# Communication & Guidance

# Are you a one armed bandit?

- Don't be an "answering machine" for the students, where they pull your arm and the correct answer falls out.

## Group work:

- How can we make students check their own answers?

### Think, pair, share:

- Spend 2 minutes alone thinking
- Discuss in groups
- Share a sentence in chat



# PÓLYA'S METHOD

I

## Identify the problem

- What is the unknown? What are the data? What is the condition?
- Draw a figure. Introduce suitable notation

D

## Develop a plan

- Draw connection between data and the unknown. Have you seen it before? Perhaps a problem with similar unknown?
- Try solving a **SIMPLER** problem.
- Try specialization and generalization of problem.

E

## Execute the plan

- Execute the plan that you just developed.
- If it doesn't work, go back to step 2 and develop another plan.

A

## Assess the solution

- Can you derive the solution differently?
- Can you use the result or method in some other problem?

# Polya's First Principle: Understand the problem

- What are you asked to find or show?
- Do you understand all the words used in the problem?
- Can you restate the problem in your own words?
- What do you know? / Is there enough information to enable you to find a solution?

“  
**IF YOU CAN'T  
EXPLAIN IT  
SIMPLY,  
YOU DON'T  
UNDERSTAND  
IT WELL  
ENOUGH**  
”

A small yellow lightbulb icon with rays emanating from it, symbolizing an idea or understanding.



# Polya's Third Principle: Carry out the plan

- Allow the students to attempt their plan on their own!
- Failing is a natural part of learning =)
- Encourage the students to pick another method to solve the problem if they did not succeed

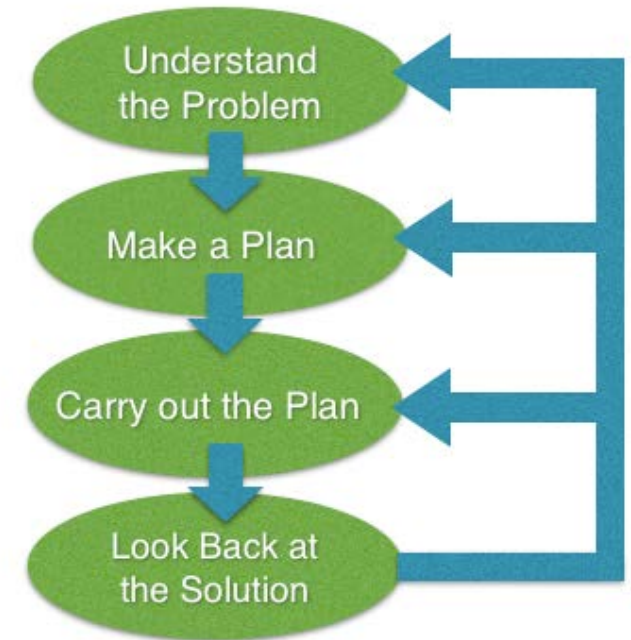


## Polya's Fourth Principle: Look back

*Every student: Is my answer correct???*

- Make the students check if their own answer makes sense.

Polya mentions that much can be gained by taking the time to reflect and lookback at what you have done, what worked, and what didn't. Doing this will enable you to predict what strategy to use to solve future problems





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## Don't

- Ask: "Do you need help?" (Avoid yes/no q's)
- "What you have done is wrong. Do X in stead."
- Not circling around in the classroom.

## Do

- Which problem are you working on?
- What is the problem asking you to do?
- What information does the problem give you?
- How far have you come / what have you tried?
- Give the student a starting point. Look at page x in the book, try this equation...

When someone tells me to  
do something I was already  
planning on doing



Well now I'm not doing it 😡

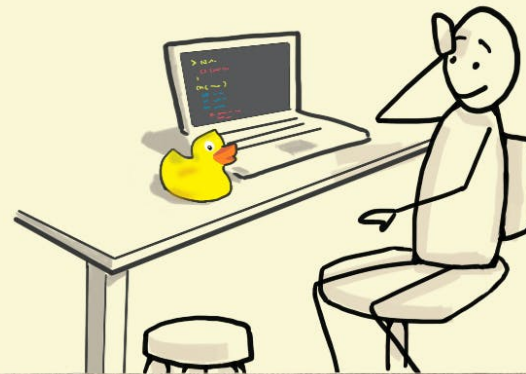
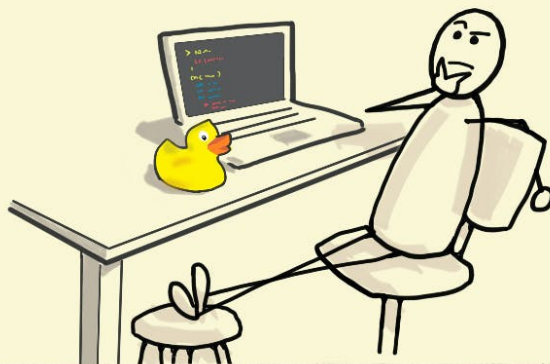
# RUBBERDUCKING

THE TECHNIQUE OF EXPLAINING YOUR PROBLEM TO AN INANIMATE OBJECT TO HELP YOU SOLVE IT

I CAN'T FIGURE OUT WHAT'S UP.  
I JUST TAKE EACH TRANSACTION  
THEN APPLY THE FILTERS IN THIS  
ORDER AND .....HANG ON...

OF COURSE! WHAT WAS  
I THINKING?? THANK  
YOU RUBBER DUCK!

!!



sketchplanations

## Open-ended Questions for Accountable Math Talk

- Compare \_\_\_\_\_. How are they the same? How are they different?
- What would you do if ...?
- What would happen if ...?
- What could you have done differently?
- If you do this instead, what will happen?
- Why did you decide to ...?
- Explain how you did ...
- Describe why you did ...
- What does (this) \_\_\_\_\_ represent?
- How did you know which ...?
- How did you know when ...?
- Consider how you could use other math tools to ...
- How could you record your work?
- How did you predict what the answer would be?
- How did you prove your estimate?

Background courtesy of <http://www.teacherspayteachers.com/Store/Krista-Walden>

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## Talk Moves

To help you learn and think critically

### REVOICING

Restate what someone else is saying by repeating, summarizing, rephrasing, or translating his/her words



### REASONING

Think about what someone else is saying and compare your reasoning to his/her reasoning



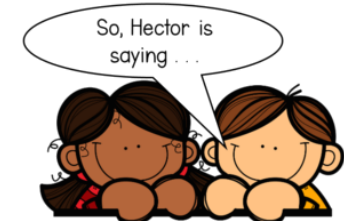
### WAIT TIME

Give others time to think about the problem or discussion and time to respond



### REPEATING

Repeat what someone said to show that what he/she said was heard and understood



### ADDING ON

Connect your thoughts and ideas to what someone else is saying



### REVISE YOUR THINKING

After listening to the thoughts and ideas of others, make changes to your thinking

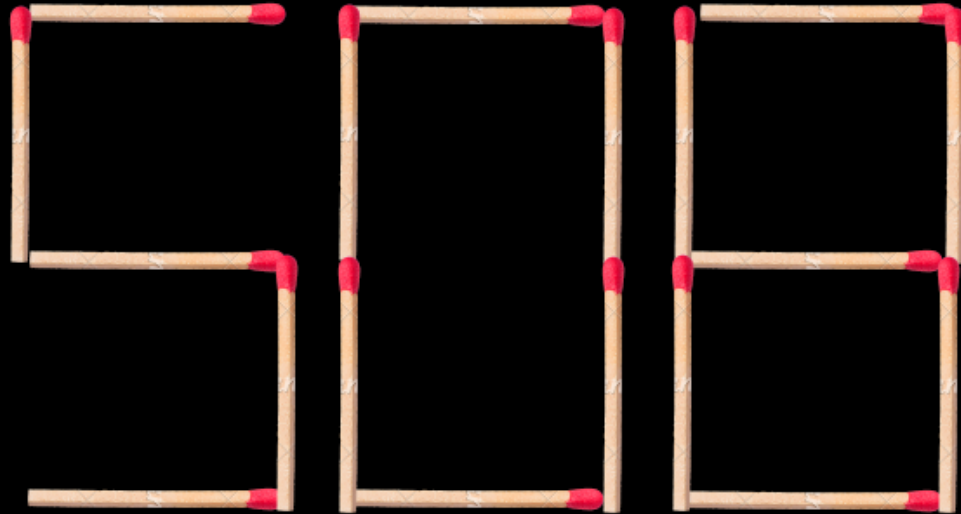




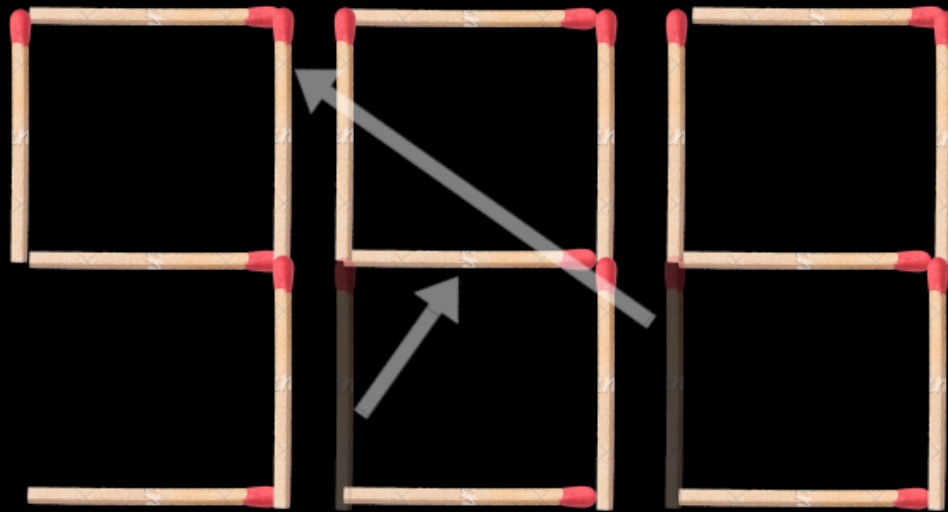
## 5 Practices for Orchestrating Productive Discussions in seminars

1. **Anticipating** • Do the problem yourself • What are students likely to produce? • Which problems will most likely be the most useful in addressing the *goal* of the seminar / exercise?
2. **Monitoring** • Listen, observe, identify key strategies  
• Keep track of approaches • Ask questions of students to get them back on track or to think more deeply
3. **Selecting** • CRUCIAL STEP – what do you want to highlight?  
• Purposefully select those that will advance *their* ideas
4. **Sequencing** • In what order do you want to present the student work samples? • Do you want the most common? Present misconceptions first? • How will students share their work? Draw on board? Put under doc cam? ...
5. **Connecting** • Craft questions to make the *themes come alive*.  
• Compare and contrast 2 or 3 students' work – what are the relationships? • What do parts of student's work represent in the original problem? The solution? Work done in the past?

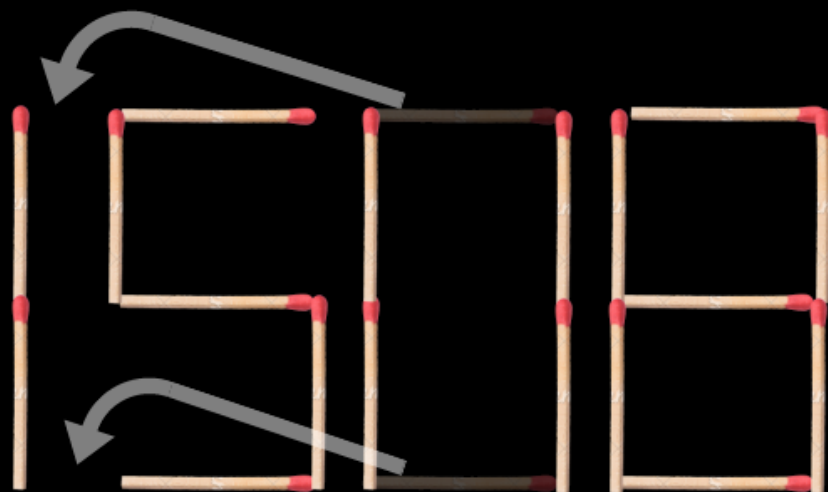
Share your solution with your neighbour.  
Can you find another solution together?



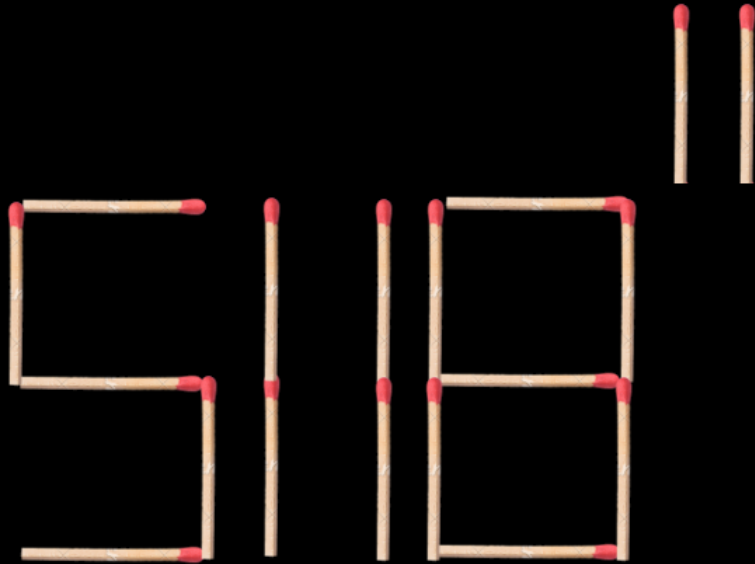
**If you can only move two matches, what is the  
biggest possible number?**



999. The highest possible 3 digit number.



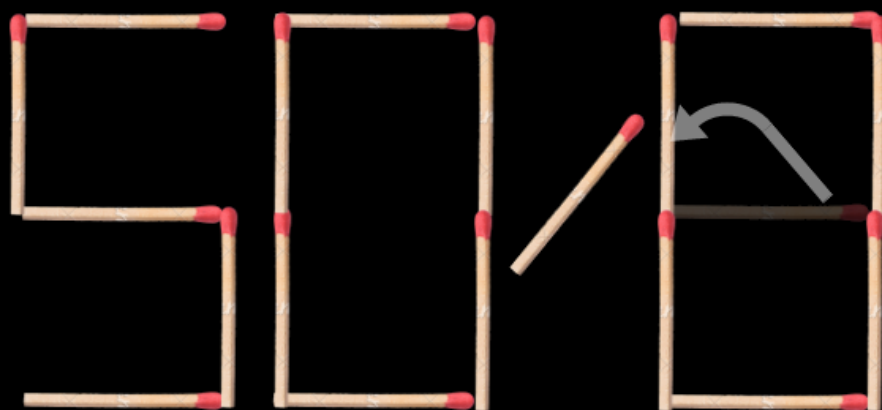
**Move the top and bottom matchsticks in the middle zero to form a new digit in front of number 5**



Use the two matches on top & below the middle zero



Use the two matches on top & below the middle zero to create power sign (^).  
5 to the power of 118



**Move the middle match in number 8 to make a  
divide sign. 50 divided by 0 is infinity**

## Summary

- Accept that the student will solve the problem differently than you – even if it is suboptimal.
- Try to ground your explanation in the attempt the student has already made.
- There is nothing wrong with you showing a "better" solution after the student has solved the problem.
- Controversial: Whether you can solve the problem or not is irrelevant. The key point is enabling the student to solve it. No point in solving the problem for the student.

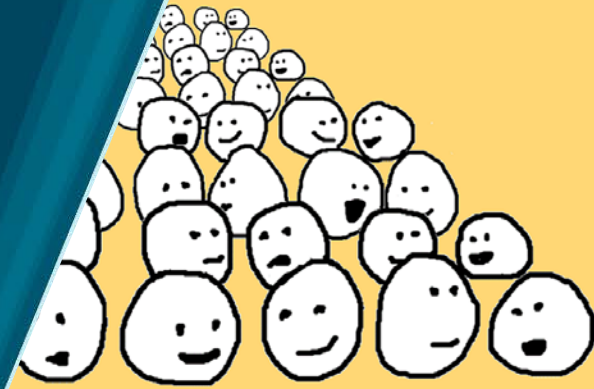




## Summary

**Techniques:** • Think Pair Share • Another and another,  
• Asking questions without giving direct answers,  
• Problem of the day

- Give the students time to think
- Planning is important.
- Your time is limited, spend it wisely!
- Convey the purpose of the lesson to the students and yourself
- Use talk moves and ask open-ended questions
- Make the students explain and do their own work.



# THINK PAIR SHARE