

Building Lessons for All Students

Gallery Workshop for Grades 9 – 12

NCTM Annual Meeting and Exhibition
Indianapolis, Indiana
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Edward C. Nolan

Our Motivation

Why did we become teachers?

What is the best way to teach?

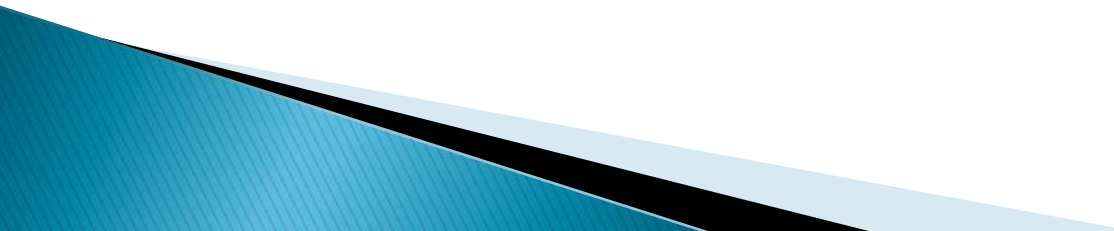
What is the best way to learn?

Is there only one way?



Lessons Evolve

We start with a basic lesson or activity and then add/revise as we find new ideas, reflect on what worked and what did not, and try to find ways to better connect with our students and their knowledge.



What Does it Mean to Teach ALL Students?

Have high expectations for all

Provide worthwhile opportunities
for all

Accommodate differences

Support needs



Checkpoint 1

1. What is a Professional Learning Community (PLC)?
2. Are PLC's important? Why?
3. How can PLC's be used to aid in lesson development?
4. How well do you understand the operation of a PLC?

1 2 3 4

My Two Goals

PLC Foci

Student Learning

Collaboration

Focused and Measureable Goals

Results



**Before criticizing someone,
walk a mile in their shoes . . .**

**that way, if they get upset,
they will be a mile away and
barefoot.**



When you improve a little each day, eventually big things occur . . . Not tomorrow, not the next day, but eventually a big gain is made. Don't look for the big, quick improvement. Seek the small improvement one day at a time. That's the only way it happens - and when it happens, it lasts.

- John Wooden

**“Learning” is more
important than
“teaching”**

Where are your students?

How do you know?

Checkpoint 2

What is differentiation?

How well do you understand differentiation?

1 2 3 4

Find a partner who has a different understanding level from yourself and share some examples of differentiation.

Differentiated Lessons

**Think about learning profiles and/or
interests**

What's the task?

**How can I modify the task to incorporate
specific learning profiles?**

**How can I modify the task to incorporate
specific interests?**



Lesson Design

Objective of the Lesson/
The Big Picture

Mastery Objective

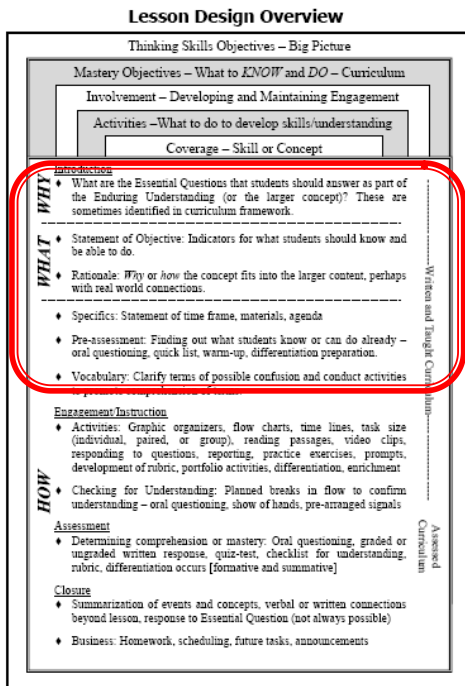
Involvement/
Developing Engagement

Lesson/Activities

Did the Students Get It?

Lesson Design Overview	
Thinking Skills Objectives – Big Picture	
Mastery Objectives – What to <i>KNOW</i> and <i>DO</i> – Curriculum	
Involvement – Developing and Maintaining Engagement	
Activities – What to do to develop skills/understanding	
Coverage – Skill or Concept	
WHY	<u>Introduction</u> <ul style="list-style-type: none">What are the Essential Questions that students should answer as part of the Enduring Understanding (or the larger concept)? These are sometimes identified in curriculum framework.
	<u>WHAT</u> <ul style="list-style-type: none">Statement of Objective: Indicators for what students should know and be able to do.Rationale: <i>Why</i> or <i>how</i> the concept fits into the larger content, perhaps with real world connections.Specifics: Statement of time frame, materials, agendaPre-assessment: Finding out what students know or can do already – oral questioning, quick list, warm-up, differentiation preparation.Vocabulary: Clarify terms of possible confusion and conduct activities to promote comprehension of terms.
HOW	<u>Engagement/ Instruction</u> <ul style="list-style-type: none">Activities: Graphic organizers, flow charts, time lines, task size (individual, paired, or group), reading passages, video clips, responding to questions, reporting, practice exercises, prompts, development of rubric, portfolio activities, differentiation, enrichmentChecking for Understanding: Planned breaks in flow to confirm understanding – oral questioning, show of hands, pre-arranged signals
	<u>Assessment</u> <ul style="list-style-type: none">Determining comprehension or mastery: Oral questioning, graded or ungraded written response, quiz-test, checklist for understanding, rubric, differentiation occurs [formative and summative]
	<u>Closure</u> <ul style="list-style-type: none">Summarization of events and concepts, verbal or written connections beyond lesson, response to Essential Question (not always possible)Business: Homework, scheduling, future tasks, announcements

Lesson Design



Objective of the Lesson/ The Big Picture

What questions should students be able to answer at the end of the lesson?

What is the Big Picture
(larger concept)?

These are often identified in
the curriculum

Lesson Sample: Understanding Variable

Thinking Question:

What is the “Big Picture” when we talk about variables and solving equations and inequalities?



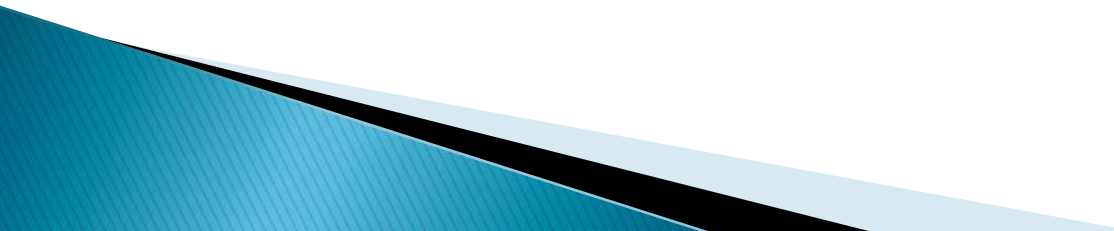
Lesson Design

Mastery Objective

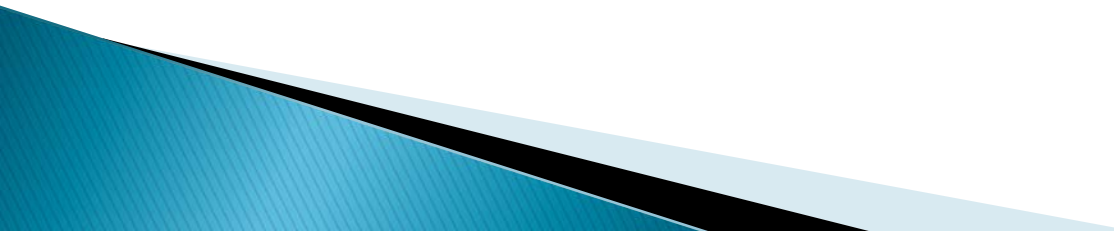
State the Objective – What should students know and be able to do?

The “**Why**” or “**How**” of the concept and placed in both a Real World and “**Big Picture**” context

Lesson Sample: Understanding Variable

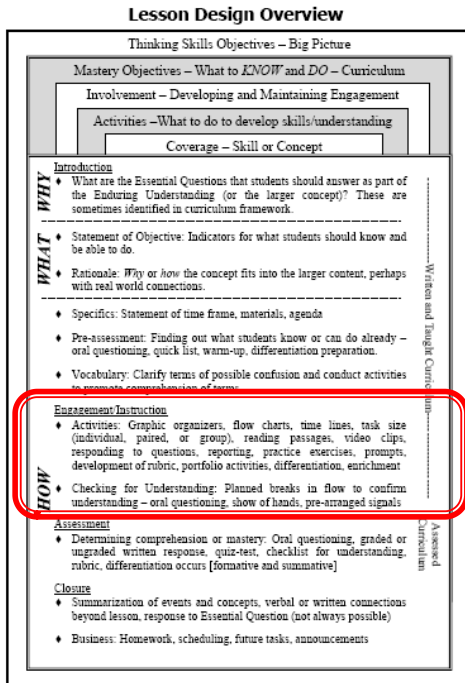
- ▶ What should students know and be able to do to demonstrate understanding about *variable*?
 - ▶ What questions do we want students to be able to answer involving variables?
- 

Lesson Sample: Understanding Variable

- ▶ When do students first learn about the use of variables?
 - ▶ What is the usual context for their understanding?
- 

Lesson Design

Involvement/Developing Engagement



Specifics: timing, materials, agenda

Pre-assessment

Vocabulary

Activities to promote comprehension

Discourse

Student engagement

Lesson Design

Lesson/Activities

Activities: Graphic organizer, individual task, paired work, or group activity, reading passages, responding to questions, practice exercises, activities

“Checking for Understanding”: Planned breaks in flow to confirm understanding: questioning/pre-arranged signals

Lesson Design

Lesson/Activities Continued

Importance of student movement
and interaction

Student choice within activities, projects, and
homework

Anchor Activities – ongoing activities that
students work on independently

Lesson Sample: Understanding Variables

- ▶ What activities will help students meet our objectives?
 - **Representing the Solution Process by Graphing**
 - **Family of Functions**

Representing the Solution Process by Graphing

1. Examine the solution to the following equation:

$$5(3 - x) + 4 = 2x - 9$$

$$15 - 5x + 4 = 2x - 9$$

$$19 - 5x = 2x - 9$$

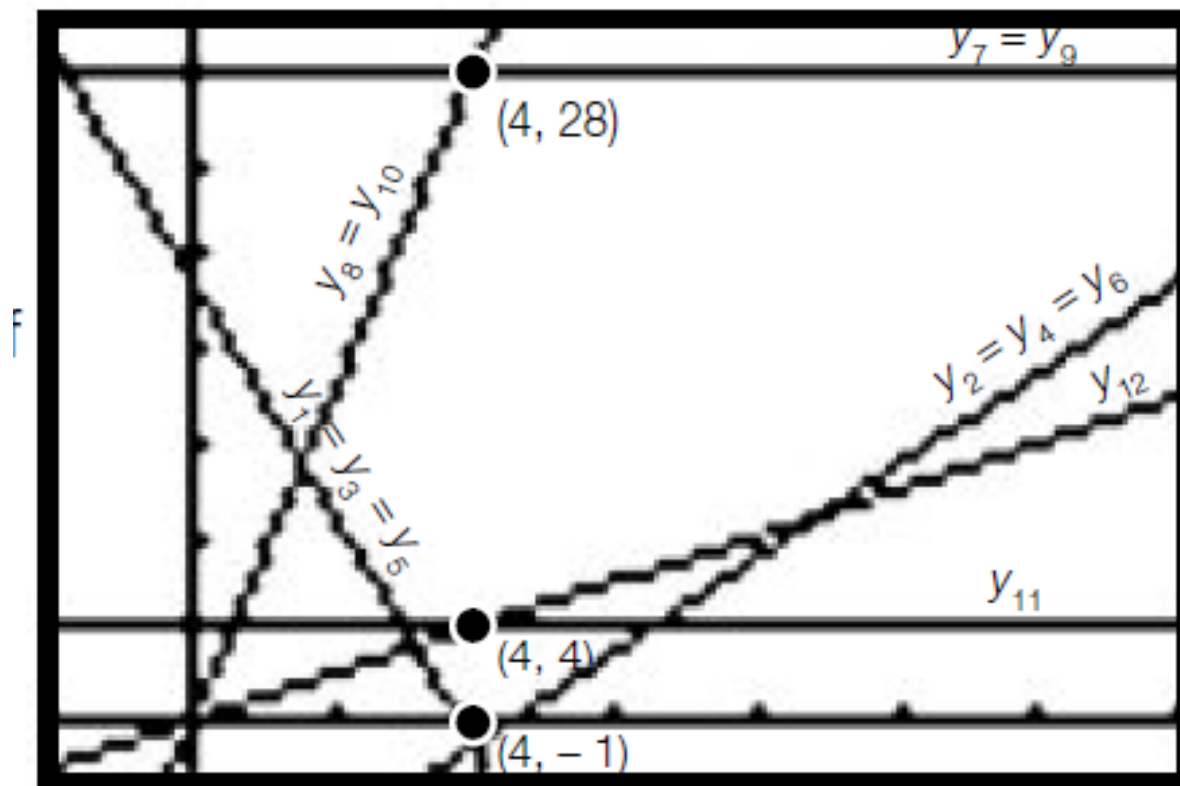
$$19 + 9 = 2x + 5x$$

$$28 = 7x$$

$$4 = x$$

2. What do you think all the functions y_1 through y_{12} , considered in pairs, in pairs have in common that will be apparent when you draw the graphs? _____
3. Use your graphing utility to sketch the pairs of functions, y_1 and y_2 through y_{11} and y_{12} . What do all the pairs of lines have in common? _____

Representing the Solution Process by Graphing



Representing the Solution Process by Graphing

3. Consider the original equation:

$$5(3 - x) + 4 = 2x - 9$$

Write a new equation from the one given with all the terms moved to the left side of the equation so that the right side is 0. If you graphed the functions y_1 and y_2 , where would the lines obtained intersect? _____ What is the meaning of this point of intersection?

4. Consider the equation that follows:

$$\frac{x^2 - 9}{x - 3} = 0$$

(a) Use the methods suggested in this worksheet to find a solution.

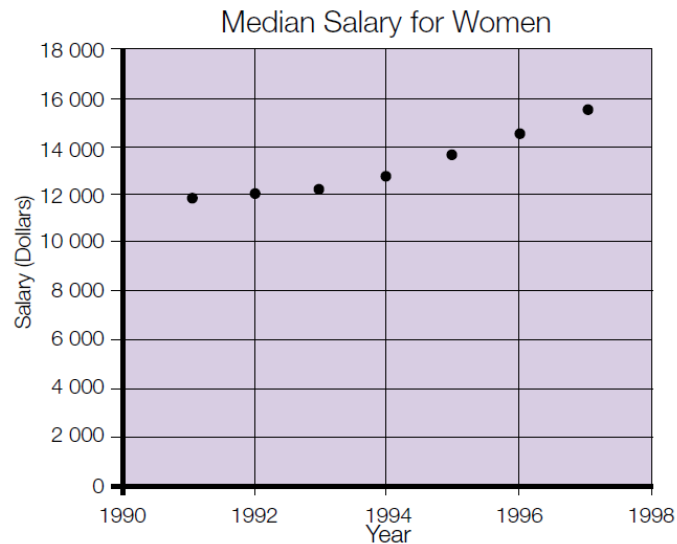
(b) Is the solution found really a solution to the original equation? ____

Explain why or why not. _____

Families of Functions

Median Salaries for Workers Twenty-five Years or Older according to Gender

Year	Median Salary: Women	Median Salary: Men
1991	\$11 580	\$23 686
1992	\$11 922	\$23 894
1993	\$12 234	\$24 605
1994	\$12 766	\$25 465
1995	\$13 821	\$26 346
1996	\$14 682	\$27 248
1997	\$15 573	\$28 919



Lesson Design

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Determining comprehension or mastery: questioning or exit card or quiz or test

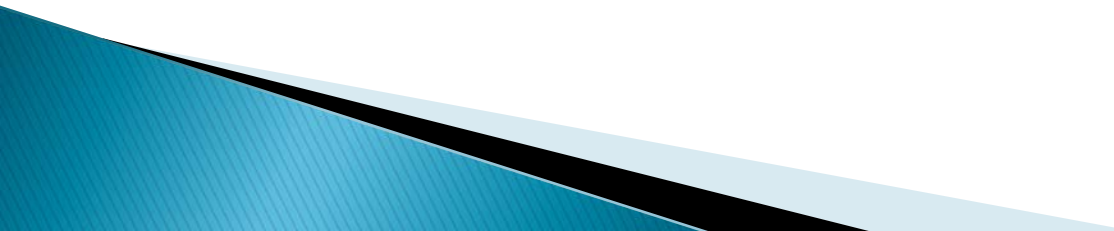
Formative and Summative

Summary of the lesson

Response to initial question of the lesson

Checkpoint 3

How do we know if students are learning?

- What evidence can we collect?
 - How do we interpret the evidence?
 - What do we do with the evidence?
 - What should students be doing?
- 

Using Ongoing Assessment

Pre-assessment

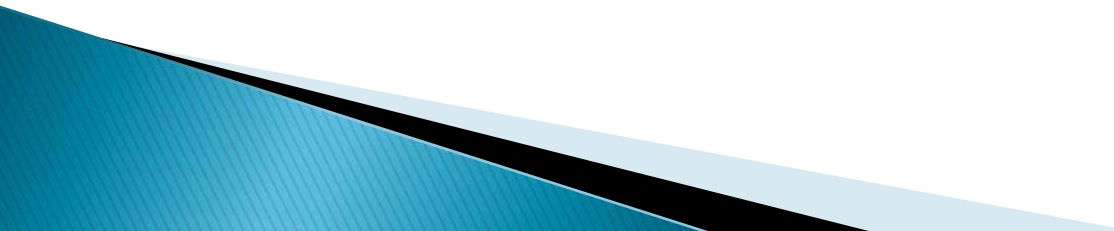
Assessment during instruction

Post-assessment



Lesson Sample: Understanding Variable

How does the type of questions we ask during the lesson help us learn if students have learned the objective?



Questioning

There are many ways to organize types of questions:

- ▶ Levels of intellectual behavior (recall, describe, apply, formulate, judge) [Bloom]
- ▶ Types of student activity (engage, refocus, clarify) [Bright and Joyner]
- ▶ Algebraic Habits of Mind (doing–undoing, building rules, abstracting) [Driscoll]
- ▶ Managing, clarifying, orienting, prompting mathematical reflection, eliciting algebraic thinking [Driscoll]

**Mathematics should be about reasoning,
not procedures**

Questions I Seldom Ask, by David R. Johnson

How many of you understand that?

Everybody see that?

You want me to go over that again?

Did I go too fast for you?

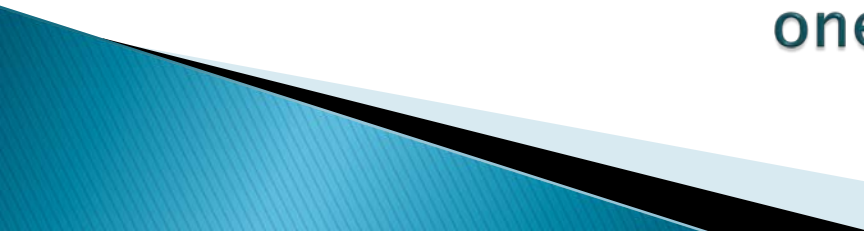
This is a right triangle, isn't it?

Right?

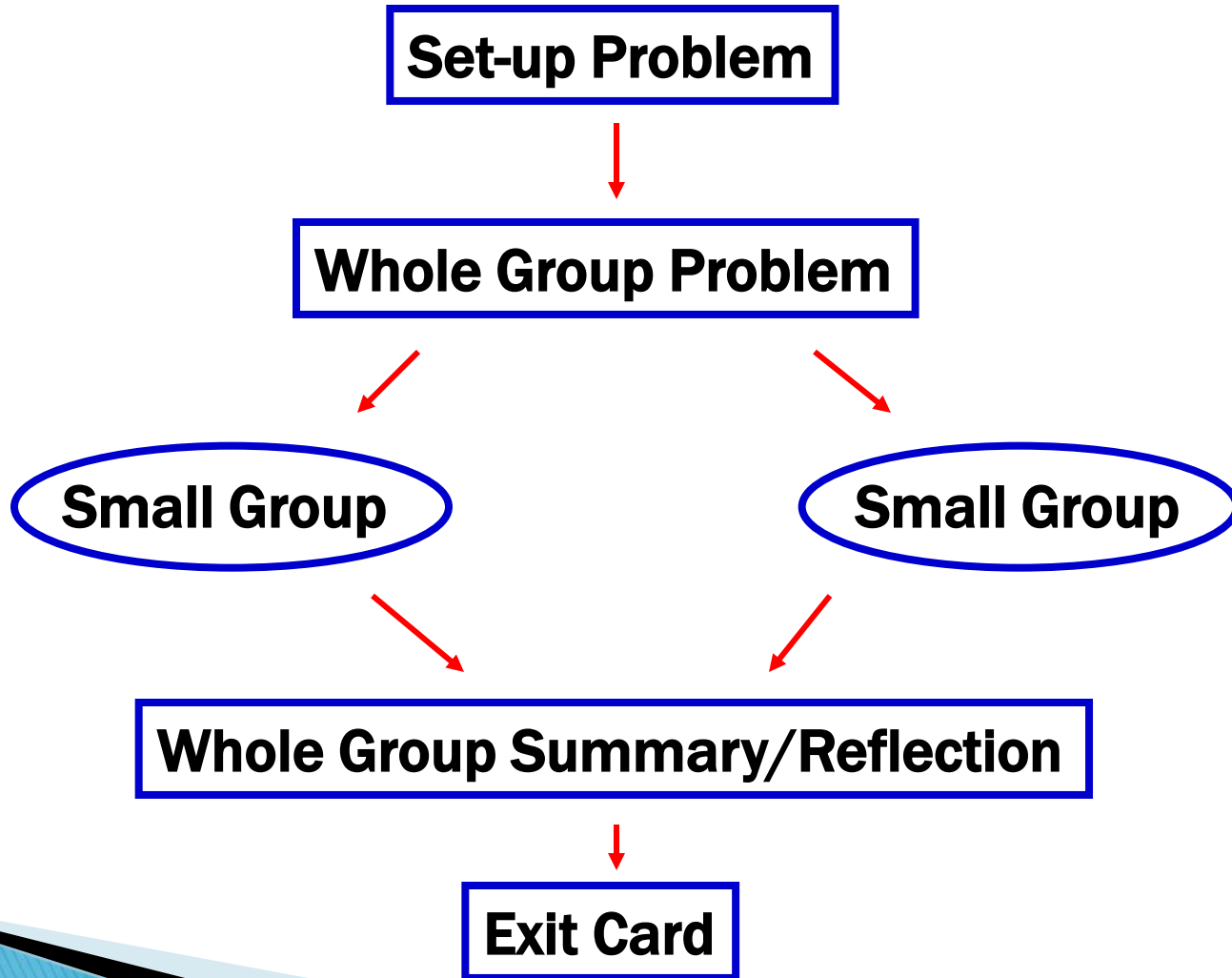
Do you have any questions?



Broad strategies for using assessment to support learning

- Clarifying and sharing learning intentions and criteria for success
 - Engineering effective classroom discussions, questions, and learning tasks
 - Providing feedback that moves learners forward
 - Activating students as owners of their own learning
 - Activating students as instructional resources for one another
- 

One Possible Lesson Design



Climate for High Achievement for All Students

Building Relationships

Group and Cooperative Learning

Confidence and Risk Taking

Learning from Mistakes

Care and Perseverance

Quick and Detailed Feedback

Effort and Effective Strategies

Empowering Students

**The old adage is true, you
can lead a horse to water,
but you can't make him
drink.**

**However, it is the teacher's
job to make him thirsty.**

Glenda Lappan



Checkpoint 4

So what is important in lesson design?

REFLECTION

Communicate clear, specific expectations.

Be direct.

Model enthusiasm.

Be positive.



REFLECTION

Move among the students.

Have high expectations.

Respect your students.


Encourage persistence.

Use humor.



**Remember, the Romans did not
build a world empire by just
talking . . .**

**OK, they did it by killing all who
opposed them, but you
get the idea. 😊**



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