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# Math Train Teacher Guide Introduction 

## Who is the materinal for?

The Math Train Teacher Guide is for preschool teachers. It is designed to help teachers develop children's early math skills, such as counting, matching quantities, simple addition, comparing, creating patterns, and recording data.

## What is it for?

Designed for preschool children, the Math Train Set uses a relevant theme which naturally incorporates math. Working with the set, children will intuitively use mathematical thinking as they build a train, tracks, and stations. Using the special multi-colored number bricks and a corresponding number of bricks in the same color as each number brick, they will recognize numerals and practice sequencing. These elements have been designed specifically to enable preschool teachers to encourage children to successfully match numbers to quantities of objects.

The Math Train Teacher Guide provides fun and engaging opportunities for exploring math-related concepts. Using the Teacher Guide, preschool teachers can facilitate exciting math lessons in which children practice sequencing as they build routes and stops for a train. They will create patterns on train cars, starting with simple patterns and exploring more complex ones as their understanding increases. The children will even practice simple addition as they load the train. Most importantly, the lessons will enable children to become problem solvers, thinking creatively as they play together!

## How are the learning objectives achieved?

Throughout the lessons, strategic questions will guide children through the process of applying math skills. Furthermore, the LEGO ${ }^{\circledR}$ DUPLO ${ }^{\circledR}$ building activities will reinforce creativity, inquiry, and exploration.

Refer to the table of contents for a brief description of lesson topics. Each lesson is labeled as beginner, intermediate, or advanced, based on the skills and knowledge needed to complete the lesson. The Teacher Guide includes two Getting Started activities designed to introduce the children to the basic ways they will be using the Math Train set. Introducing these activities first will give the children a solid foundation for completing the other six lessons. Subsequent lessons may be selected and adapted according to what is most relevant and appropriate for the children.

## Appendix with Images

The appendix contains printable images. Some of these can be used to extend the lessons and to help demonstrate the children's ability to transfer what they have learned.

The appendix also includes inspiration photos of lesson-related models. The inspiration photos can be used to help the children connect with the lesson, and may also be used as building inspiration when they are constructing their own models.

## Customizing to Your Class Needs

The Math Train lessons can be tailored to your needs and the needs of your class. One Math Train set can be used with up to six children at a time, working in pairs. Children need a lot of practice before becoming proficient at building with a partner, and this is a good way to promote collaboration. If the children are ready, you may incorporate partner building in all of the activities.

The activities can be done in centers or stations around the classroom, or in small groups. Personalizing the scenarios and content to fit your classroom dynamics and physical setup will help the children connect with the lessons.

The Math Train set and Teacher Guide can be combined with any other LEGO® DUPLO ${ }^{\circledR}$ set for even more learning possibilities. Combining other DUPLO sets with the Math Train set will also provide more building opportunities.

Expect differentiated learning outcomes based on each child's existing knowledge, vocabulary, and experience. Children's verbal responses, models, and solutions will vary. Support the children's learning by adapting the discussion questions and making connections that are relevant to them.

## Lesson Structure

Each lesson is structured according to a natural learning flow called the LEGO® Education 4C approach, which promotes successful learning experiences. The Connect, Construct, and Contemplate phases, which are the first three phases of each lesson, can be done in one session. The Continue phase is more challenging and can be completed in a later session.

## Connect

During the Connect phase, discussions will spark children's curiosity and activate their existing knowledge while preparing them for a new learning experience.

## Construct

In this phase, the children will participate in a hands-on building activity. As their hands create models of people, places, objects, and ideas, their minds will organize and store new information related to these structures.

## Contemplate

During the Contemplate phase, children are given the opportunity to reflect on what they have done and to talk about and share insights they have gained during the Construct phase of the lesson. This phase encourages children to develop their problem-solving skills as well as techniques that are crucial for mathematics, and all areas of life!

## Continue

New challenges in this phase build upon the concepts learned previously in the lesson, providing an opportunity for children to apply their newly-acquired knowledge during extension activities. Some Continue activities include an option to utilize one of the printables found in the appendix. Because the children may not be ready to complete the Continue phase until they have repeatedly practiced the skills learned earlier in the lesson, this phase can be done during a later session.

## Did you notice?

The Mathematics guidelines from the National Association for the Education of Young Children (NAEYC) and HeadStart have been used to develop the Math Train lessons. Please refer to the learning grid for an overview of the learning values referenced throughout this Teacher Guide. The learning goals listed at the end of each lesson can be used to determine whether or not each child is developing the relevant early math skills. These bullet points target specific skills or pieces of information that are practiced or presented during each lesson.

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| Getting Started Train Time |  | － |  |  | － |  |  |  |
| Getting Started Matching Numbers |  |  |  |  |  |  |  | － |
| Load the Train |  |  |  |  |  |  |  |  |
| Check the Train |  |  |  |  | ， |  |  |  |
| Sequencing Stops |  |  |  |  | ． |  |  |  |
| Patterning Train Cars |  |  | O | － |  |  |  |  |
| Longest Track |  |  | － |  |  | O |  | － |
| Best Friends Numbers |  |  | ， |  |  |  | O |  |

## Getting Started

Train Time

## For up to 4 children

## Materials needed:

Math Train set (45008), inspiration photos

## Connect

- Ask the children to help you describe a train.
- Consider asking questions like:
- What does a train look like?
- What does a train sound like?
- What does a train do?
- Introduce the children to the Math Train set:
- Show a track piece and ask the children to identify it.
- Model putting two track pieces together.
- Model putting two train cars together and placing them on the tracks.


## Construct

- Tell the children that they are going to help build tracks and a train.
- Give each child a track piece and ask them to take turns connecting their pieces.
- Encourage the children to count the pieces as they are connected.
- Place one of the train cars on the track and place the number one brick on it.
- Encourage the children to help you connect another train car and to tell you what number should be placed on it (i.e., two, three, etc.).
- Continue adding as many cars as you would like, encouraging the children to identify the next number in the sequence.


## Contemplate

- Facilitate a discussion about the train and tracks you have just built.
- Consider asking questions like:
- How many track pieces did we use?
- Is our train track long or short?
- How many train cars did we use to make the train?


## Continue

- Tell the children that they need a train engine to go with the tracks and train cars.
- Ask them to work in pairs to build a train engine. Show them the inspiration photo and encourage them to be as creative as they would like!


## Did you notice?

Observing the following skills can help you monitor whether the children are developing the necessary competencies in math.

- Counting using number names, and beginning to recognize the number of objects in a set
- Sequencing numbers or events


Inspiration photos (see appendix)

## Getting Started



## For up to 6 children

## Materials needed:

Math Train set (45008), removable tape, a play mat, or something similar to mark a circle large enough for multiple children to stand inside, inspiration photo, printable graph (see appendix; one per child), crayons or colored pencils

## Connect

- Ask the children to sit in a circle.
- Build a tower and model how to count the bricks one by one to find the total number of bricks used.
- Consider asking questions like:
- How many bricks were used to build the tower?
- How did I find the total number of bricks?
- Tell the children that they are going to play counting games.
- Use removable tape, a play mat, or something similar to mark a circle large enough for multiple children to stand inside.
- Tell the children that when you hold up a brick with a number on it, the same number of people must jump into the center of the circle.
- Model the activity by holding up the number one brick and jumping into the center of the circle yourself.
- Ask the children, "how many people are inside the circle?"
- Hold up the brick representing the number of children participating in the activity so that they all must jump into the circle.
- Count the children one by one to "check" the total.
- Repeat with as many numbers as desired.


## Construct

- Tell the children that they are going to practice using the special number bricks.
- Model this activity by showing the number one brick and finding the corresponding number of bricks in the same color (i.e., one red brick).
- Ask the children to take turns finding the next number brick in the sequence of 1-10. Then encourage them to find the corresponding number of bricks in the same color (i.e., two orange bricks, three yellow bricks, etc.).
- Ask them to place the flat red $2 \times 4$ bricks on top of the number bricks and then stack the corresponding color bricks on top as shown in the inspiration photo.
- Encourage the children to check their work by counting the bricks out loud as they build.


## Contemplate

- Facilitate a discussion about numbers.
- Consider asking questions like:
- Which number did you add to the model/sequence?
- How many colored bricks did you have to find to match your number?
- What do we use numbers for?
- Why are numbers important?


Learning Outcomes
Children will:

- Explore the components of the Math Trainset
- Begin matching numbers to quantities
- Practice counting and recognizing the number of objects in a set



Inspiration photo (see appendix)

## Continue

- Use the stacks of bricks to play a game.
- Put all of the number bricks in a pile, then ask the children to take turns matching the number bricks to the stacks of bricks.
- Give each child a copy of the printable graph and ask them to color in the appropriate number of bricks for each number in the graph. For younger children, model the activity and complete it as a group.


## Did you notice?

Observing the following skills can help you monitor whether the children are developing the necessary competencies in math.

- Counting using number names, and beginning to recognize the number of objects in a set
- Recording simple data in a chart or graph


Printable graph (see appendix)

## Load the Train

## For up to 6 children

## Materials needed:

Math Train set (45008), inspiration photos, small objects (e.g., pens, crayons, notepads, erasers)

## Connect

- Talk to the children about freight trains:
- Freight trains haul objects, materials, and all sorts of things!
- Freight is a general word we use to describe these things.
- Tell the children that some freight must be loaded onto the train and it's very important that the correct amount is loaded. Too much freight and the train will be too heavy!


## Construct

- Tell the children that they are going to help load the train.
- Model picking up a number brick, placing it on a train car, and finding the corresponding number of bricks in the same color.
- Load the bricks onto the train. You can even use the crane to help you! Point out that the number tells you how many bricks must be loaded onto the train.
- Encourage the children to try it on their own by picking a number, placing it on a train car, and finding the matching bricks.


## Contemplate

- Encourage a discussion about making sure the train has the correct amount of freight.
- Consider asking questions like:
- How many bricks did we need to load onto the train?
- How did we check to make sure we loaded the correct amount?
- Why is it important to make sure that the train is carrying the correct amount of freight?


## Continue

- Tell the children that freight trains can deliver all sorts of items, then ask them to collect "freight" (e.g., pens, crayons, notepads, erasers) from around the classroom and load it onto their train cars.
- Have them find the number brick that corresponds to the number of items they have loaded onto their train car.
- Once the children have loaded their train cars, facilitate a discussion about more and less by picking two train cars and asking the children which one has more and which has fewer.
- For a greater challenge, ask the children to help you place the train cars in order from least to most freight being carried.


## Did you notice?

Observing the following skills can help you monitor whether the children are developing the necessary competencies in math.

- Using mathematical terms, such as positional language, number names, etc.
- Counting using number names, and beginning to recognize the number of objects in a set

Learning Outcomes Children wills

- Practice matching numbers to quantities
- Practice comparing quantities


freight train, freight, count, load, more, less


## Check the Train

## For up to 5 children

## Materials needed:

Math Train set (45008), inspiration photo, printable manifests (see appendix; one per child), pencils

## Connect

- Explain that passenger trains transport people to different stops.
- Ask the children if they have ever ridden on or seen a passenger train.
- Encourage one or two children to share their experiences.
- Ask the children to think about items passengers might need to take with them on the train (e.g., luggage, snacks).


## Construct

- Tell the children that they are going to build a passenger train.
- Give each child a printed copy of a manifest and explain that the manifest lists what belongs on each train car.

- Ask the children to choose a train car and to find the number brick, figure, suitcase, and food item from their manifest and place them on their cars.
- Ask the children to look at each manifest and check each car to make sure that it is carrying the correct passenger, suitcase, and food item. Encourage them to make check marks to indicate that all of the expected people and items are on the train.

Tip:" There is a page of blank manifests in the appendix that the children could use to create their own lists.

## Contemplate

- Facilitate a discussion about checking the train cars.
- Consider asking questions like:
- How did you make sure each car had one passenger, one suitcase, and one food item?
- Why is it important to check the train before it leaves the station?
- What would happen if one of the passengers left without his or her suitcase?
- Are the train cars in the correct order?
- As a group, count how many passengers, suitcases, and food items there are total. Point out that there is the same number of each.


## Continue

- Ask the children to close their eyes, then rearrange the passengers and items on the train cars so that they do not match the manifests anymore.
- Ask the children to open their eyes and tell them that the train is in chaos and needs to be sorted before it can leave the station!


## Did you notice?

Observing the following skills can help you monitor whether the children are developing the necessary competencies in math.

- Using mathematical terms, such as positional language, number names, etc.
- Counting using number names, and beginning to recognize the number of objects in a set
- Sequencing numbers or events


Printable manifest (see appendix)

## 

Inspiration photo (see appendix)

## Sequencing Stops

## For up to 5 children

## Materials needed:

Math Train set (45008), inspiration photos

## Connect

- Talk to the children about how train travels. Explain that a train moves along the tracks but must make a stop whenever it reaches a station.
- Tell them that you will be playing a game called stop and go!
- Explain that when they hear you say, "all aboard," they will move around the classroom pretending to be trains and that they must stop when you say, "pulling into the station." If they don't listen carefully, they will miss the station!


## Construct

- Tell the children that they are going to build train stations and help the train make its stops in the correct order.
- Encourage each child to build a place for the train to stop. It can be a classic station or another interesting place like a park or a market. Show them the inspiration photos and encourage them to be as creative as they would like!
- Once each child has finished building, ask them to work together to build a train track long enough that they can place their models along the edge to form train stops. As a group, place a number brick at each stop and tell the children to make sure the number bricks are placed in the correct order.
- Have the children take turns moving the train along the track and pulling into each stop to load or unload passengers.
- As they move the train, encourage the use of sequential language (i.e., the train goes to stop one first, then to stop two, etc.)


## Contemplate

- Facilitate a discussion about the train stops.
- Consider asking questions like:
- How many train stops did we build?
- How many stops did the train need to make?
- How did the train know where it should stop next?
- Facilitate a discussion about the importance of sequencing the stops in order. Talk about the consequences of the train stopping in the wrong order (i.e., angry passengers).


## Continue

- Explain that sometimes trains have instructions to drop-off or pick-up items or people at specific stops, this is called a schedule
- Encourage the children to set-up the train stops and role-play making their own train schedule (e.g., pick-up three people at station one, drop-off four suitcases at station two).


## Did you notice?

Observing the following skills can help you monitor whether the children are developing the necessary competencies in math.

- Using mathematical terms, such as sequential language, positional language, number names, etc.
- Counting using number names, and beginning to recognize the number of objects in a set
- Sequencing numbers or events


Inspiration photos (see appendix)

## Patterning Train Cars

## For up to 6 children

## Materials needed:

Math Train set (45008), inspiration photos

## Connect

- Tell the children that they are going to explore patterns.
- Ask the following questions to help them connect with the lesson:
- What are patterns?
- What are some examples of patterns?
- Point out some patterns around the classroom.
- Tell the children that they are going to become a "living pattern."
- Ask them to stand in a circle. Tell every other child that they should say "awesome" when you point to them and tell the other children that they should say "patterns."
- Go around the circle pointing to each child. It should sound like, "awesome, patterns, awesome, patterns."

- Explain that this is a pattern and that parts of a pattern repeat, which means that once they understand the repeating order, they will know what comes next.


## Construct

- Tell the children that patterns can also consist of shapes and colors, and that they are going to make patterns on train cars.
- Show the inspiration photos, pointing out the different kinds of patterns.
- Explain that some use bricks built on top of one another and other patterns cover the train car.
- Ask each child to pick one of the inspiration photos to replicate. Encourage them to use different colors or to create an entirely new pattern. Remind them that each of their patterns should repeat. If necessary, help them sort the bricks they need.
- Once the children have finished building, ask them to take turns saying their patterns out loud (e.g., "orange, yellow, orange yellow").


## Contemplate

- Encourage the children to discuss their patterns.
- Consider asking questions like:
- How many colors are in your pattern?
- How many times does your pattern repeat?


## Continue

- Encourage the children to create their own patterns.
- Help them decide on the colors and shapes they will use, gather the bricks, and build their patterns. Remind them that their bricks must repeat at least once in order for it to be a pattern.
- If they are ready, ask them to work together to create a pattern using multiple train cars.
- Build a simple pattern on the first train car, and another simple pattern on the second car.
- Repeat the pattern from the first car on the third car, and the pattern from the second car on the fourth car, etc. (see the appendix for an example).


## Did you notice?

Observing the following skills can help you monitor whether the children are developing the necessary competencies in math.

- Using mathematical terms, such as positional language and color names
- Categorizing by one or more attributes and comparing two or more objects
- Recognizing and creating increasingly complex patterns


Inspiration photos (see appendix)

## Longest Track

## For up to 4 children

## Materials needed:

Math Train set (45008), inspiration photos, printable graph (see appendix; one per child), pencils, tape measure

## Connect

- Gather the children around the train set and show them two different trains; one with two train cars and one with three.
- Place the trains side by side and ask children to compare them.
- Consider asking questions like:
- Which is shorter?
- Which is longer?
- How can you tell?
- Tell the children that all sorts of things can be measured. For instance, the length of each train can be measured to verify which is shorter and which is longer.
- Using a standard method of measurement like a ruler or tape measure, ask the children to help you measure both trains, then record your findings.
- Measure again using the number bricks stacked together as a form of nonstandard measurement. Record your findings.
- Facilitate a discussion about your findings.


## Construct

- Challenge the children to work together to build train tracks that reach as far across the room as possible. Start at the wall for easier measuring later on.
- Encourage them to experiment with different designs, but each must use all available track pieces.
- Help the children measure each design using a standard form of measurement. Model measuring in a straight line from the start of the track (the wall) to where it stops in the room. The tracks will be curved, so be sure to point out that you are not measuring the length of each piece but how far the track reaches into the room.
- Give each child a copy of the printable graph and ask them to record each measurement.


## Contemplate

- Facilitate a discussion about the children's experience building the tracks.
- Consider asking questions like:
- Which track design was the longest and why?
- How did you measure the track?
- Why is it important to measure distance and length?

Learning Outcomes
Children will:

- Practice measuring
- Begintolearn about standard and nonstandard measurement - Compare distances and length



## Continue

- Say: "We can measure all sorts of things!"
- Explain that people often want to measure height.
- Have the children work in pairs to build a tower or crane.
- Ask them to measure their models and compare.
- Challenge children to make their models even taller. If they are ready, ask them to work together, using as many bricks as possible, to build a mega crane. Make sure to measure and document it.


## Did you notice?

Observing the following skills can help you monitor whether the children are developing the necessary competencies in math.

- Comparing two or more objects
- Exploring measurement, and beginning to use standard and nonstandard forms of measurement
- Recording simple data in a chart or graph


Inspiration photos (see appendix)

## Number Friends

## For up to 4 children

## Materials needed:

Math Train set (45008), inspiration photos, in-box cards

## Connect

- Gather the children around the train set and show them two train cars with different quantities of bricks loaded onto them (e.g., one with six green bricks and the number six brick, and another with four light green bricks and the number four brick).
- Place the cars side by side and ask the children to compare.
- Consider asking questions like:
- Which train car has the most bricks?
- Which train car has the least bricks?
- Explain that sometimes people want to know how many items there are altogether and that we can figure this out by adding.
- Encourage the children to count the total number of bricks on both train cars. Point out that the two quantities (i.e., six and four) added together make ten, and so we can call six and four best friends of ten!

Tip": If making sums of ten is too difficult, use smaller numbers.

## Construct

- Explain that several sets of numbers are "best friends of ten."
- Tell the children they will be working with a partner to create "best friends of ten" train cars.
- Ask each pair of children to find two number bricks that add up to ten. You may use the in-box card as an example.
- Ask each child to place a number brick on a train car and find the corresponding number of bricks in the same color. If they need help, show them the inspiration photos, which they can duplicate.
- Once the children have finished building, have them count the bricks on each train car. Then ask them to count their pair's bricks altogether--which make ten!


## Contemplate

- Facilitate a discussion about "best friends of ten."
- Consider asking questions like:
- How many sets of "best friends of ten" there are?
- What other numbers add up to ten?
- Write out the sets as children say them. If time allows, encourage the children to build each set of "best friends" and share with the group.

Learning Outcomes
Ginidren will:

- Count and recognize the number of objects in a set
- Match numbers to quantities
- Compare quantities
- Practice simple addition



## Vocabulary

number, quantity, add, altogether, compare, most, least, best friends


Examples of in-box cards

## Continue

- Challenge children to create "best friends of twelve" train cars.
- The combinations which can be built using the set include:
- Two and ten
- Three and nine
- Four and eight
- Five and seven
- Look at the in-box cards and use the ideas shown on the cards to help the children find the bricks needed to add up to twelve.


## Did you notice?

Observing the following skills can help you monitor whether the children are developing the necessary competencies in math.

- Counting using number names, and beginning to recognize the number of objects in a set
- Comparing two or more objects
- Exploring simple operations, such as adding

OSOD education
Train Time - Inspiration Photo




C300 education
CGOD education



CESO education
Load the Train - Inspiration Photos

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Load the Train - Inspiration Photos






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Number Friends - Inspiration Photos<br>C300 education





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LEGO ${ }^{\circ}$ Education Preschool solutions stimulate children's natural curiosity to explore together and learn through play. Our preschool solutions will support you in developing your preschoolers in the following ways:

- give them social skills to collaborate and communicate with the world around them
- let them discover their own capabilities and acquire fundamental life skills
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