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DiToM
Diagnostic Tool in Mathematics

Screening 0+

Handbook for teachers

2025.

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Contents

Foreword

This manual is designed to support you in administering the *DiToM* 0+ screening and in using the test results effectively with your class. On the following pages, you will find:

1. a brief introduction to the aims and guiding principles of the Erasmus+ project *DiToM*;
2. detailed, step-by-step instructions for conducting *DiToM 0+* in the classroom;
3. concise explanations of each task in *DiToM 0+*, including notes on possible support strategies for children whose screening results indicate learning gaps in key mathematical competencies;
4. guidance on how to evaluate and document the results.

The administration guide (Section 2) and the evaluation tables (Section 4) can also be downloaded separately as individual PDF files from http://www.ditom.org/

We recommend printing the administration guide double-sided and spiral-binding it. In the booklet that you will get, you can keep the teacher-facing page for reading the instructions aloud, while the page facing the children often includes an example that helps you explain what the children are expected to do.

1) Aims and Guiding Principles of *DiToM*

Mathematics learning progresses in stages: new knowledge builds on secure prior understanding. When fundamental ideas and concepts are missing, students find it increasingly difficult to grasp and make sense of mathematical content that builds upon that foundation. Both national and international studies show that a significant proportion of students already fail to meet the minimum standards in mathematics at the primary level—and, for the reasons described above, almost inevitably continue to struggle in secondary school. Alarmingly, many young people finish their compulsory education without having achieved the basic level of mathematical literacy that, according to the OECD, is essential for "full participation in social life."

To counteract this, teachers must first be able to identify mathematical learning difficulties—ideally early and as precisely as possible. Only on this basis can targeted support measures be taken. This is precisely where the EU project *Diagnostic Tools in Mathematics (DiToM)* comes in. In a partnership between Germany, France, Greece, Croatia, Italy, Sweden, and Spain, five interconnected screening instruments were developed. These tools enable teachers, at the end or beginning of a school year, to gain a concise overview of which students are at risk of falling behind in mathematics if they do not receive targeted support measures.

The screenings follow a two-year cycle:

- **Screening 0** – Beginning of primary school
- **Screening 2+** – End of Grade 2 / Beginning of Grade 3
- **Screening 4+** – End of Grade 4 / Beginning of Grade 5
- **Screening 6+** – End of Grade 6 / Beginning of Grade 7
- **Screening 8+** – End of Grade 8 / Beginning of Grade 9

What are the *DiToM* Screenings and what do they achieve?

The five screenings are paper-and-pencil tests focused on key mathematical competencies that should be secure at the start of a grade level for new content to be learned with understanding. Each test can be administered to the whole class within a single lesson and, using the provided scoring tools (see Section 4), evaluated with relatively little time investment. The results give teachers an initial structured overview of which children are likely to need additional support in particular areas.

The word *"likely"* is crucial: a screening does **not** replace an individual, qualitative assessment of a child's learning status. At best, it provides initial clues as to what strategies or solution approaches a child may have used. More detailed understanding requires targeted observation and one-on-one discussions, using more finely differentiated tasks. The screening, however, can serve as a valuable starting point to determine which children would benefit most from such follow-up assessments.

What are “key mathematical competencies”?

As noted earlier, school mathematics is characterized by an *“internal learning hierarchy”* (Wittmann, 2015, p. 199). This is particularly true in the domains of arithmetic (numbers and operations) and algebra—the very areas that *DiToM* screenings intentionally focus on. In these domains, it is possible at every learning stage to identify *key competencies*—those without which further learning cannot take place meaningfully and sustainably.

For example: To work successfully with natural numbers, children must understand them in terms of the *part–whole concept*—a developmental process that should be completed during the first school year. The part–whole concept means, for instance, that the number seven is understood as a whole composed of parts—five and two, four and three, one and six, and so on. This understanding should then become automatic: a child should no longer need conscious effort to recognize five as the missing part of seven when two is given as the other part. In other words, children should automatically think of numbers in terms of their decompositions and relationships. This combination of *understanding* and *automation* is characteristic of many key competencies: only once certain skills are automatic can mental capacity be freed up to tackle higher-level mathematical challenges.

Whether the key competency of “thinking of numbers as compositions” (or “number decomposition”) is well established can be seen, for instance, in a child’s calculation strategies. A child who thinks of seven as five and two will solve 7 – 5 effortlessly, even in the first school year, without counting. Children who lack this competency, however, often continue to rely on laborious, error-prone counting strategies well into later primary and secondary grades. Counting-based addition and subtraction soon become unmanageable when two- or three-digit numbers are involved. Such children also struggle to use relationships between multiplication facts—for instance, recognizing that 9 × 6 is six less than the easily remembered 10 × 6. Deficits in one key competency (understanding numbers as compositions) thus hinder the acquisition of others (addition, subtraction, multiplication), which in turn are prerequisites for more advanced skills (division, proportional reasoning, etc.).

This chain continues beyond primary school: students who struggle with natural numbers will face even greater difficulties with fractions and decimals. Algebra, later on, builds on insights that should have been gained from working with the basic operations in primary school. Without those insights, algebra can appear to students as an indecipherable code.

For this reason, the *DiToM* screenings focus on key competencies—those that should be securely established at the start of Grades 1, 3, 5, 7, and 9, so that further mathematical learning can proceed successfully.

After administering the *DiToM* screening – what’s next?

Using the evaluation tools described in Section 4, teachers create a table (Excel or paper) that can be read in two directions:

- **Across rows:** Each child’s results show which tasks were solved correctly, partially correctly, incorrectly, or left blank—resulting in an overall score for that child.

- **Down columns:** For each task, the table shows how many children solved it correctly, partially correctly, incorrectly, or not at all.

With a view on individual students:

DiToM is not about labeling children. The screenings are **not** designed to identify students with "dyscalculia." Clinical diagnoses of that kind do not address the core question that *DiToM* seeks to answer: *How can teachers best support children struggling with key arithmetic competencies?* Targeted support requires an accurate understanding of each child's current learning level. *DiToM* helps identify those for whom such detailed assessment is urgently needed—nothing more, but also nothing less. Section 3 provides brief notes on what kinds of follow-up support may be helpful for each specific task.

The "critical threshold scores" given in Section 4 were determined based on trials of the *DiToM* screenings with 8,820 children across the seven partner countries. Using *latent class analysis* (see Livingston, 2014), children were grouped as follows:

- **Group A:** Children showing widespread difficulties across several key competencies.
- **Group B:** Children showing indications of difficulties in specific areas.
- **Group C:** Children showing no major indications of difficulty.

It is important to remember that any screening captures only a *snapshot*. Some children may simply have had a bad day or been distracted, others might have—despite precautions—copied answers. Screening results should therefore be interpreted cautiously. They should always be compared with observations from daily classroom, and used as a prompt for further targeted observation and follow-up tasks in the coming days and weeks.

If it becomes clear that a child falls into Group A, there is reason to expect that their mathematical difficulties will worsen over the school year unless timely and effective interventions are implemented. Section 3 can only suggest general directions for such interventions, based on the key competencies assessed by each task. For more extensive guidance, teachers must refer to the relevant educational literature.

Children in **Group B** are also likely to need targeted support in at least some areas to progress successfully in their learning. It is worth remembering that all screening tasks assess *key* competencies. The screening is intentionally designed *not* to distinguish among high achievers—ideally, most children should find the tasks quite easy. Therefore, any errors made by **Group C** children on individual tasks should also be taken seriously, as they may reveal gaps in key foundational skills.

With a view on the class as a whole:

The latter applies particularly when the results show that multiple children struggled with the same task. This may indicate that they have received insufficient or unfocused practice with that competency, either in their prior schooling or before entering school. In such cases, it is all the more important that these learning opportunities now be provided, even if the curriculum has already moved on to new content. Again, it is important to take into account the hierarchical structure of mathematics learning: each level depends on secure understanding of the foundational competencies before moving forward.

2) Instructions for Administering Screening 0+

Screening 0+ is designed for use with the entire class at the beginning of Grade 1.

It comprises the following tasks:

1 Translating number words into numerals

2 Perceptual subitizing

3 Conceptual subitizing

4 Emerging part-whole understanding

5 Comparing sets

6 Ordinal understanding (number after)

7 Counting

8 Ordinal understanding (number before)

9 Counting out a quantity

The following section provides detailed, task-by-task instructions on what to tell the children before and during the administration of the test.

These instructions are also available as a **separate PDF file for download**, expanded with sample and blank pages for printing. If you print this file double-sided and bind it with a spiral, you will have a booklet from which you can read the instructions aloud during the test and refer back to key points to keep in mind during administration. The additional pages included in the print version allow you, by turning the left side of each double-page, to hold up the booklet and read the instructions from the page in front of you, while the children can see the corresponding example task on the back of the booklet.

Before and During the Distribution of Test Booklets

Tell the children that at the end (Preschool) / beginning (Grade 1) of the school year, that you would like to find out, what the children already know and can do.

Inform them that each of them will receive a little booklet with tasks to solve and that you will guide them through the tasks and tell them what to do.

Explain to them that it is important that they do the tasks by themselves and that it is not helpful, if they copy from their neighbours, because in their booklets there are different tasks. Stress that it does not matter, if they do not know the answer for some tasks.

Tell the students to use a pencil. Explain that using a razor takes too much time and show them on the board what to do, when they realise that they have written something wrong: Cross out what is wrong and write the correct answer above, below or next to it.

Tell the children that you will lead them through the tasks one by one and that you will explain what to do for each task. **Ask them NOT to go ahead by themselves.**

Explain to them, that it is important that they pay attention and listen carefully to your instructions. To help them solve the tasks, you will give an example to the whole class, before they work on the tasks by themselves.

Make sure that all desks are empty, and that each child has only a pencil in front of them.

Tell the students that you are about to hand out the booklets **and stress that for the moment the booklets will stay closed** on their desks until you ask them to open them.

Now hand out the booklets and invite the students to write their first name and class on the front page.

Please note:

- The dot pictures related **Item 2** and **Item 3** are not the examples but belong to the task. Only show these dot pictures when it is pointed out in the instruction.
- For **Item 4** you can choose between two versions. Only do one version and skip the other. **Do not do both tasks.**

Furthermore, there is **no example**, so the picture of the hand and the candy, i.e. option A (alternatively of the pencil case and the coloured pens, i.e. option B) belongs to the task. Show it when pointed out in the instruction.

1 Translating number words into numerals

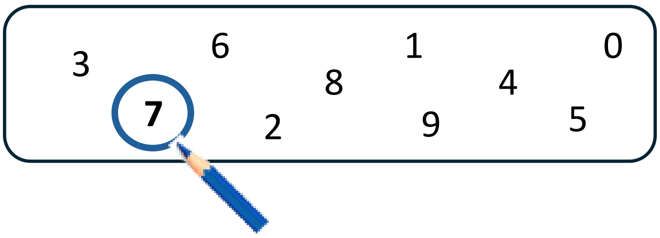
Example

“Look at this box.”

→ *Point to the box in the example.*

“We wanted to find the number 7. Here it is.” →*point to the number7*

We found the number 7 and we made a circle around it.



Screening tasks 1a - 1d

“Now I want you to circlesome numbers. Please turn your page.”

1a: “In the top corner you see a little **horse**. That is the right page. Now look at the numbers and circle the number **2**. Look for the **2**.”

1b: “Now turn over your page until you see a **cat** in the top corner. The next number to find is **5**. Find the **5** and circle it.“

1c: “Well done. Turn your page over and you will see a **bird** in the top corner. Find the page with the bird. Now look at the numbers and circle the number **6**. Find the **6** and circle it.”

1d: “One more number. Turn over your page and you see a **fish in** the top corner. We are looking for the page with the little fish. The last number to find is **9**. Find the **9** and circle it.“

“Well done. Please put your pencil down on your desk. We will do something different now.”

2 Perceptual subitizing

No example for this task!

Screening task 2

"Now please turn the page over and you will see a **star** in the top corner. You see the star? That is the right page."

"In a moment I will show you a picture with dots. But I will show it only once and only very quickly. So, you must pay attention. All eyes on me."

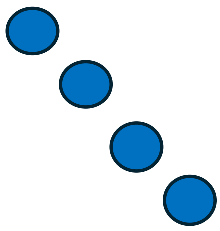
"Once you know how many dots are in my picture, I want you to find that number in the box and circle it."

"Do not call out the number so that all the others can hear. Keep it to yourself."

"Ready? Look at the picture and circle the right number on your page."

"Ready, set, go!"

Show the picture with the dots for just **1 second!**



"Now circle the correct number."

"Well done. You can now turn over to the next page"

3 Conceptual subitizing

No example for this task!

Screening task 2

“Now please turn the page over and you will see a **sun** in the top corner. Look for the page with the sun.”

“In will show you another pages with dots. Look at me and pay attention.”

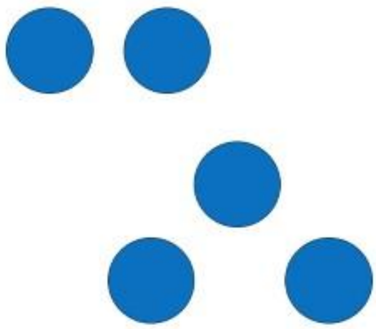
“Again, I want to know how many dots you saw.”

“Remember: Do not call out the number so that all the others can hear Keep it to yourself.”

“Ready? Now look at the picture and circle the right number on your page.”

“Ready, set, go!”

Show the picture with the dots for just **1 minute!**



“Now circle the correct number.”

“Well done. Please put your pencil down on your deskI will show you another picture.”

4 Emerging part -whole understanding Option A

No example for this task!

Screening task

"Look at this picture."

→ *show the picture for Item 4*

"Now there are **5** candies altogether.
You can see **3** candies here".

→ *point out the 3 candies*

*"*And some are hidden in the hand. We cannot see how many are hidden in the hand"

→ *point at the hand*

"How many are hidden, if there are **5** candies altogether? Don't call out the number!"

"Instead, circle the right number in the box."

"Once you are finished, please put your pencil on your desk."

"We move on to the next task now."

4 Emerging part -whole understanding Option B

No example for this task!

Screening task

"Look at this picture."

→ *show the picture for Item4*

"Now there are **5** pencils altogether. You can see**3** pencils here".

→ *point out the 3 pencils*

*"*And some are hidden in the pencil case. We cannot see how many are hidden in the pencil case."

→ *point at the pencil case*

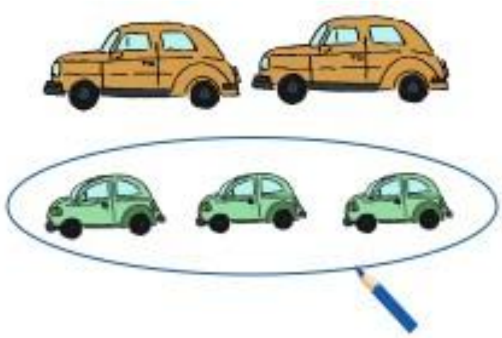
"How many are hidden in here, if there are **5** pencils altogether? Don't call out the number!"

"Instead, circle the right number in the box."

"Once you are finished, please put your pencil on your desk."

"We move on to the next task now."

5 Comparing sets



Example:

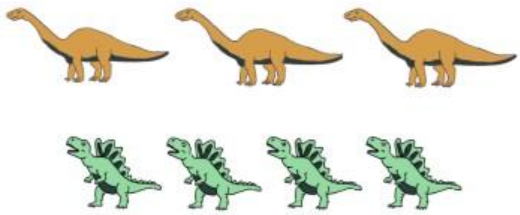
"Please look at this picture."

→ *show the example*

"You see red cars and blue cars. But there are more blue cars than red cars."

"This is way I have circled the blue cars. There are more blue than red cars."

Screening task9a:



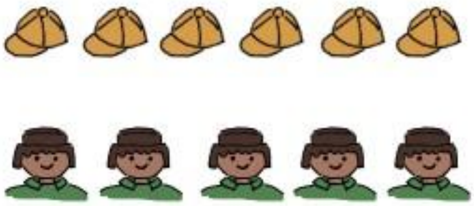
"Please turn your page over to the next task."

"On this page you see dinosaurs"

"One row at the top and one row below."

"Circle the row where there are **more** dinosaurs. Where are **more** dinosaurs? In the top row or in the bottom row? Circle that row."

Screening task 9b:



"Now please turn over to the next page."

"Here you see caps and heads."

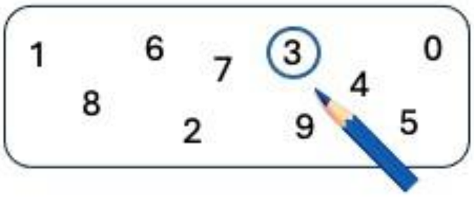
"Are there more heads or caps?"

"Circle the row where there are **more. More** caps or more heads?

"Once you are finished, please put your pencil on your desk."

6 Ordinal understanding (number after)

Example



„What number comes after 2 when you count?
→ *let the students answer*

”That is right. The number **after 2 is 3**.
One, two, **three**. This is why I have circled the number 3.”
→ *hold up the example and point to the number 3*

Screening task

6a: “Now, please turn the page over and you see an **apple** in the top corner. Does everybody see the apple? Good.“

“When I count, which number comes ***after 5***?
Do not call out the number. Circle it on your page.
The number **after 5.**”

6b: “Please turn the page over and you see a **banana** in the top corner. Put your finger on the banana.”

“Now, when I count, which number comes ***after 3***?
Do not call out the number. Circle it on your page.
The number **after 3.**”

6c: “Now, please turn the page over and you see an **orange** at the top corner. Put your finger on the orange.”

“When I count, which number comes ***after 3***?
Do not call out the number. Circle it on your page.
The number **after 7**.”

“Once you are finished, please put your pencil on your desk.”

7 Counting

no example needed

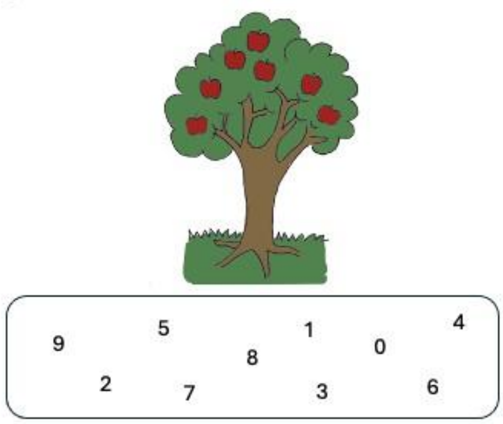
Screening task

“Please turn your page over to the next task.”

“Here you see an apple tree with nice red apples.”

“How many apples are hanging on the tree?
Count the apples and then circle the the right number in the box.”

“How many apples are hanging on the tree?”

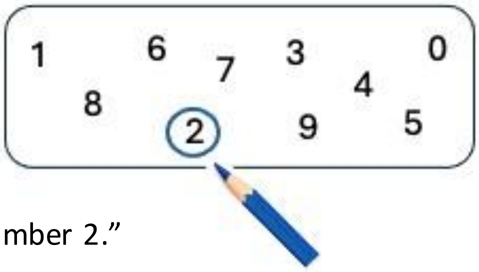


“Once you are finished, please put your pencil on your desk.”

“You are doing really well. Only two more tasks to go.”

8 Ordinal understanding (number before)

Example



„What is the number before 3 when you count?

→ *let the students answer*

"That is right. The number **before 3 is 2**.
One, **two,** three. So I have circled the number 2."

→ *hold up the example and point to the number 3*

Screening task

8a: "Now, please turn the page over and you see a **T-shirt** in the top corner. Does everybody see the T -Shirt?
When I count, which number comes ***before 6***?
Quiet. Do not call out the number! Circle the number **before 6** on your page."

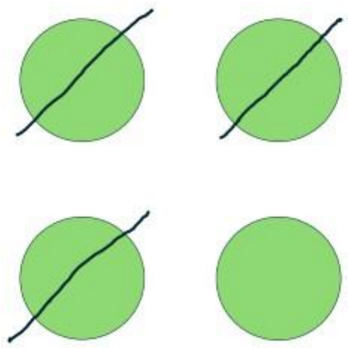
8b: "Now, please turn the page over and you see a pair of **shorts** in the top corner. Does everybody see the shorts?
When I count, which number comes ***before 4***?
Do not call out the number! Circle the number **before 4** on your page."

8c: "Now, please turn the page over and you see a **cap** in the top corner. Does everybody see the cap?
"When I count, which number comes ***before 8***?
Do not call out the number! Circle the number **before 8** on your page."

"Once you are finished, please put your pen on your desk.
Well done. We only have one more task to do"

9 Counting out

Example



"Look at these four circles."

→ *show the example*

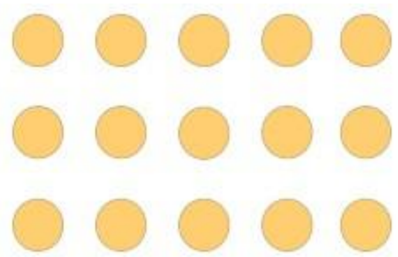
"I have crossed out 3 circles."

→ *point to each of the three lines*

"Can you see that?"

Screening task

"Please turn the page over to our last task."



"Here you see more circles."

"Cross out **8** circles. Eight circles need to be crossed out."

"Please cross out 8."

"Once you are finished, please put you pencil down, close your booklet and I will come around and collect it."

→ *After collecting all the booklets: Thank the children for their hard work and cooperation and treat them with a run around the school yard or a game!*

3) Explanations and suggestions for support regarding the single tasks of *DiToM* screening 0+

Task 1: Translating number words into numerals

Which precursor skill is assessed in this task?
Task 1 tests whether a child can match the number words from one to nine with the corresponding numeral.

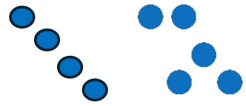
Why is this precursor skill important for learning school mathematics?
Even though most children can already read numbers up to 10 confidently when they start school, the introduction of numerals and their clear writing is an explicit topic of mathematics lessons in the first few weeks of the first school year. However, at the end of kindergarten or at the beginning of school, not all children have mastered reading numerals. For a paper-and-pencil test such as Screening 0+, this is necessary to test their knowledge and ability to work with quantities and numbers. Therefore, the first task of the screening uses four number words (two, five, six, and nine) to test whether the children can identify and circle the corresponding numerals.

Which mistakes or difficulties might arise when doing this task?
Frequently observed errors include confusing the numerals 6 and 9, as well as 4 and 7. Children who are not yet familiar with number symbols either circle numbers at random or refrain from completing the task altogether. If the child does not yet recognize the corresponding number symbol, the only way to determine whether the child knows the number word “five”, i.e., associates it with a quantity of five objects (cardinal number understanding) and correctly positions it when reciting the number word series (ordinal number understanding), is to conduct the test orally with the individual child.
Children who do not score any points in task 1 most likely do not yet know the numbers from 1 to 9, or only know them partially, and for this reason have made mistakes or not written down any solutions in most of the other tasks in the screening.

How can children be given appropriate support?
When the above-described errors occur, it is helpful to conduct the interview orally, with the child giving the answers verbally. This allows you to check whether the child has already developed an understanding of cardinal and ordinal numbers and is simply unable to read the number symbols yet. In class, special attention should then be paid to ensuring that the child has sufficient opportunity to learn the number symbols. This is usually combined with exercises in writing the digits clearly. Exercises in which the number word must be translated into the symbol and vice versa are helpful in transferring between number words, numerals, and quantities.

Furthermore, it can be helpful for the teacher to know whether a child who does not yet have sufficient English language skills, already knows the digits and can use them confidently. The use of number cards then helps with learning English number words and allows symbolic solutions to tasks involving counting and subitizing.

Tasks 2 and 3: Perceptual and conceptual subitizing



Which precursor skills are assessed in these tasks?
These two consecutive tasks test whether a child can subitize quantities of 4 and 5 elements, i.e. without counting the objects individually.

Why are these precursor skills important for learning school mathematics?
Children transitioning from kindergarten to elementary school are generally able to subitize numbers up to 4 perceptually and, with the help of individual structures, also grasp 5 (or more) objects without counting (conceptual subitizing). Over the past ten years, research projects using eye trackers have shown that even young children can structure quantities of 5 or more elements and conceptually subitize the total number by quickly breaking down the 5 into 1 and 4 or 2 and 3.

The ability to recognize small quantities without counting is important when working with illustrative materials and visualizations such as the arithmetic rack or the 10 array. For children to move away from counting as a strategy for solving simple addition and subtraction problems, they must be able to use materials to illustrate operational calculation strategies such as "bridging 10" or "doubling" without counting.

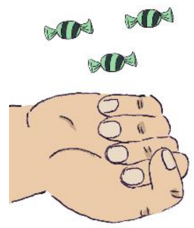
Which mistakes or difficulties might arise when doing these tasks?
It is important for teachers to know if a child is unable to subitize small quantities perceptually and/or conceptually at the beginning of school, as this ability is a prerequisite for the conceptual subitzing of larger quantities and the use of the "power of five." Since the two images are only shown for 1 second each, it is usually not possible to count the dots. The children then guess the answer or do not fill in anything at all.

How can children be given appropriate support?
Children who are unable to perceptually subitize quantities of up to four objects when they start school, should be given regular exercises to help them learn this skill. First, cards with one and two objects are shown, then the number of elements is gradually increased to three and four. The time that each quantity is shown is then systematically reduced. The goal a presentation time of one second. The teacher can start with significantly longer presentation times of several seconds, which allow the objects to be counted, and by repeatedly varying the presentation of the objects, recognition and thus the transition away from counting to subitizing will become increasingly successful.

A similar approach is taken for conceptual subitizing. Here, you start with five objects and slowly increase the number while gradually shortening the presentation time. It is important to talk to the children about how to structure the objects, e.g., "I see three here and two there, five in total," and to discuss different ways of structuring them.

Task 4: Emerging part-whole-understanding

Which precursor skill is assessed in this task?
This task tests whether children understand that a total quantity can be made up of (in this case, two) partial quantities.



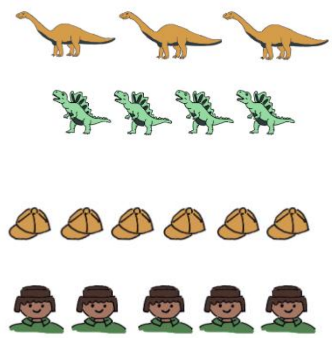
Why is this precursor skill important for learning school mathematics?
Part-Whole understanding is central to the concept of numbers as quantities or cardinal numbers and thus makes a significant contribution to number concept development. The concept describes a child's understanding that a quantity (e.g., 5 candies) can be divided into subsets (e.g., 2 candies in the hand and 3 candies on the table) and that this division can be reversed by combining the subsets back into the total quantity. Children first develop this understanding in relation to concrete quantities and later develop these insights further and transfer them to abstract sets of numbers. They then know that the number 5 can be divided into 1 and 4 (or into 3 and 2), or that the number 5 can be derived from 3 and 2. Part-whole understanding also relates to basic concepts of arithmetic operations. For example, combining or adding two quantities to form a total quantity is a central basic concept of addition, while splitting a total quantity into two subsets is a basic concept of subtraction.

Understanding the parts-whole concept is a prerequisite for operative calculation strategies such as "bridging 10". 5 + 8 can only be solved with this strategy if the second summand **8** is split in a way, that 5 + **5** = 10 and 10 + **3** = 13. The same applies to subtraction: 15 – 7 is calculated by splitting the subtrahend **7** so that 15 – **5** = 10 and 10 – **2** = 8. Understanding that numbers such as 8 are not whole entities, but that they can be split into other numbers such as 3 and 5 (or can be created from other numbers), is essential for understanding and using operative Strategies for calculation.

Which mistakes or difficulties might arise when doing this task?
Part-whole understanding is a topic in early school mathematics. However, international studies show that most children entering school have initial, context-based insights into this concept and can apply these in class, enabling them to use part-whole understanding at an abstract level. Children who have not yet grasped this concept when starting school need targeted support in this area to avoid calculation difficulties later on.

How can children be given appropriate support?
Children who with difficulties understanding part-whole relationships on a concrete level should be given the opportunity to first develop context-based insights into splitting and putting together quantities, which they can then transfer to abstract numbers Concrete actions such as splitting 6 tiles into two sets and then putting them back together to form the original set, or cutting up and reassembling set images, are important practical experiences in this regard. It is important to ensure that the actions are expressed verbally and described appropriately, e.g., "I split six into two and four" or "two and four make six."

Task 5: Comparing sets



Which precursor skill is assessed in this task??
This task tests the ability to directly compare two quantities regarding the question "Where is there more?"

Why is this precursor skill important for learning school mathematics?
Since Piaget's work on number concept development, the direct comparison of quantities based on qualitative characteristics, e.g., color or shape, and quantitative characteristics (e.g., number or length) has been considered an important precursor skill. Being able to compare quantities directly and knowing the appropriate terminology ("two quantities are equal," "this quantity is smaller (larger)," "there is less (more) here") is important for the development of ordinal and cardinal number understanding. The ability to compare two or more numbers, e.g., 4 and 7, without an accompanying representation of quantity in terms of their size prepares children for orientation in the abstract number space. Depending on their individual level of development, children use different comparison strategies. Depending on the number of objects and their presentation, the difference is perceived either pre-numerically in a purely visual way – you see the difference – or via one-to-one correspondence. Here, the children connect one element of one set with one element of the other set. The set with remaining elements is then logically interpreted as "is larger" or "has more elements."
However, a quantifying comparison is also possible. In this case, the elements of both sets are counted, and the set with the higher number is consequently interpreted as being larger or has more elements. Some children even quantify the difference, e.g., "There are two more." Careful observation of the children as they solve the problems or a close look at the solutions in the test booklets often provides information about the solution strategy.

Which mistakes or difficulties might arise when doing this task?
Children usually encounter difficulties when the smaller quantity appears to be "more" or "larger" due to the size of the objects or the way they are arranged. Children who circle the row with the three larger dinosaurs in task 9a have not yet understood that when comparing quantities, the size of a quantity should be interpreted in terms of the number of its elements. In task 9b, the elements are arranged in two rows of equal length, but this does not necessarily mean that there are the same number of objects in both rows. Children who circle both rows rather believe that both quantities are the same size.

How can children be given appropriate support?
If the difficulties described above are observed, it should be made clear to the child that when comparing "more or fewer objects," it is only the number of objects that matters, not the size or way the objects are arranged. It is helpful to start by working with movable objects of the same size and different sizes that can be moved, added to, reduced, and rearranged repeatedly. One-to-one correspondence should be made through action, and any remaining elements should be interpreted in terms of a comparison of numbers. Once children understand direct comparison through one-to-one correspondence, the next step is to count the number of elements, i.e., compare them abstractly.

Tasks 6 and 8: Ordinal understanding of numbers

Which precursor skills are assessed in these tasks?

These two tasks test whether children have internalized and automated the number sequence up to 10 in such a way that they can name the successor or predecessor of a given number, both forwards (task 6) and backwards (task 8).

Why are these precursor skills important for learning school mathematics?

Counting skills up to at least 10 are important for understanding numbers. This should be linked to the realization that numbers systematically increase by one when counting forwards and decrease by one when counting backwards. Having a stable number sequence is the basis for counting and counting out quantities (see tasks 7 and 9), in which each element of a given quantity is counted exactly once. The stable number sequence must be linked to one-to-one correspondence. Confident forward and backward counting, conveyed through basic insights into numbers, is also a prerequisite for children to learn non-counting strategies for addition and subtraction tasks in the number range up to 10. An understanding of part-whole relationships (task 4) is essential for the latter.

Which mistakes or difficulties might arise when doing these tasks?

Errors occur when children either have not yet automated the number sequence or are not yet confident in reciting it in the correct order. Most children can confidently recite the number sequence up to ten when they start school. Counting backwards is often less practiced, although many children can do this in the sense of a “rocket launch” (counting down from ten to zero). However, the reverse sequence is often produced more like a poem (always starting at ten and ending at zero) and less like a conscious counting backwards, in which the individual numbers is consciously perceived and associated with corresponding quantities. As a result, counting backwards is often only successful from ten to zero and not when starting with five or eight. Accordingly, many children have significant difficulties when counting backwards from different starting numbers or when asked to name the “number before”.

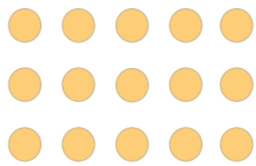
How can children be given appropriate support?

If it is observed that a child can name the successors correctly and the difficulties only concern the predecessors, this is usually due to a lack of practice in counting backwards. In this case, children should be given ample opportunities for practicing counting backwards.

Tasks 7 and 9: Counting objects and counting out

Which precursor skills are assessed in these tasks?
These two tasks test if a given unstructured set can be counted (task 7), and if the elements of a given set can be represented (task 9).

Why are these precursor skills important for learning school mathematics?
In order to be able to solve simple addition and subtraction problems such as 3 + 5 or 7 – 4, first in context and later on a purely abstract numerical level, children must not only have a purely verbal command of the number sequence but also be able to associate the corresponding numbers with quantities. In addition to understanding numbers as ordinal numbers (see tasks 6 and 8), this involves understanding numbers as cardinal numbers that indicate the quantity of a set. When counting, knowledge of the stable number sequence must be combined with one-to-one correspondence, i.e., each element must be counted exactly once while no elements may be forgotten during the counting process. This applies to both counting and counting out. When counting out, all elements (i.e., the entire quantity) are represented for a given number.



Which mistakes or difficulties might arise when doing these tasks?
A common mistake is that children forget single objects or count them twice, especially when counting immovable objects as in task 7, because they do not have a strategy to ensure that they count each item exactly once.
If difficulties arise when counting out (task 9), e.g., 7 or 9 circles are falsely crossed out, this tends to indicate that the number sequence is not yet stable or objects counted twice. In both cases, performing similar tasks orally and observing the child closely and having them count aloud helps to identify and correct and errors.

How can children be given appropriate support?
If children have problems counting all objects in a fixed setting, where objects cannot be moved, exactly once, counting movable objects is a good first step. One by one each object is counted and then moved aside, so that they are not counted again. The child should also count aloud so that any problems with the number sequence can be identified. The reason for moving the objects aside should be discussed. Once this is mastered, the child can move on to counting unmovable objects. Right at the beginning, it should be discussed how to ensure that all objects are counted exactly once, even if they cannot be moved, e.g., by immediately crossing out or marking the counted objects that have been counted already in any way, to keep track of which objects have already been counted.

If problems arise during counting out (as in task 9), quite frequently the number word sequence is not yet stable. Another reason might be, that the child is counting correctly but is forgetting to represent one or more elements or, in this case, to cross them off. Children should be encouraged to cout aloud so that the specific problem can be precisely located.

4) Notes on the Evaluation and Documentation of results

To help you evaluate the test results, various tools are available for download at https://www.ditom.org/

If you prefer to evaluate the tests manually, we provide the following aids:

a) An **overview sheet for scoring**, which lists for each task the criteria for awarding one point, half a point, or no points (see page 25);
b) A **class evaluation sheet** for recording and documenting the results of the entire class (see page 26).

A much less time-consuming option is to evaluate the results in Excel on your computer. For this purpose, you can download:

c) A **pre-programmed Excel file** with two worksheets that you can switch between via the tabs at the bottom left.

In the sheet titled “qualitative”, simply enter, in the appropriate column for each child, the numbers the child wrote in their test booklet as answers to each sub-task. If a child left an item blank, please enter 999. When you have finished entering the data, switch to the “quantitative” sheet. The program will then automatically indicate whether each sub-task was answered correctly (1) or incorrectly (0) and will calculate the appropriate score for each overall task (1 / 0.5 / 0). At the end of each row, you’ll find the percentage of correctly solved tasks and the total score for the individual child. At the end of each column, you’ll find the percentage of children in the class who solved that particular task correctly.

The “Critical Score Thresholds” for *DiToM 0+* — and How to Interpret Them

As explained in Section 1, *DiToM* is not intended to label children. Please refer back to the discussion of *DiToM’s* goals and guiding principles in that section.

There you will also find a more detailed explanation of the “critical score thresholds,” which were determined based on pilot testing of *DiToM* (for version 0+, with 1,150 students in the final piloting across the project’s seven partner countries) using the statistical method of Latent Class Analysis. This method makes it possible to assign children, based on their total score in *DiToM 0+,* to one of the following three groups:

Score Range	**Group**
0 to 5.5	A - Signs of broad difficulties across several key areas
6 to 7	B - Indications of difficulties in some key areas
7.5 to 9	C- No indication of major difficulties in key areas

A final note referring back to Section 1: Keep in mind that a screening provides only a snapshot. The results should therefore be compared with your own classroom observations and experiences and, where indicated, used as a starting point for follow-up interviews with individual children — to deepen, refine, or expand your understanding, and, if necessary, to adjust your conclusions at least in part.

Evaluation and Scoring *DiToM* Screening 0+ (max. 9 points)

1a-d	Translating number words into numerals 	1 P 0,5 P 0 P	all 4 numbers correct (**2, 5, 6, 9**) at least 3 numbers correct all other solutions
2	Perceptual subitizing 	1 P 0 P	**4** was marked all other solutions
3	Conceptual subitizing 	1 P 0 P	**5** was marked all other solutions
4	Emerging part-whole understanding 	1 P 0 P	**2** was marked all other solutions
5	Comparing sets (more)	1 P 0 P	**both** parts of the task correct all other solutions
6	Ordinal number understanding (number after) 	1 P 0,5 P 0 P	all 3 numbers correct (**6, 4, 8**) at least 2 numbers correct all other solutions
7	Counting (apples on the tree)	1 P 0 P	**7** was marked all other solutions
8	Ordinal number understanding (number before) 	1 P 0,5 P 0 P	all 3 numbers correct (**5, 3, 7**) at least 2 numbers correct all other solutions
9	Counting out a quantity	1 P 0 P	**8** circles were crossed out (or clearly marked in another way) all other solutions

Please note: The scoring applies to both test versions A and B.

Class Overview DiToM Screening 0+ (max. 9 P.) Class ………… Date ……………………

Name of the child	Age Y:M	Special Needs including NESB	1 Number words to numerals	2 Perceptual Subitizing	3 Conceptual Subitizing	4 Part-whole-understanding	5 Comparing sets	6 Number after	7 Counting	8 Number before	9 Counting out a quantity	**Overall score**

References

Livingston, S. A. (2014). *Equating Test Scores (without IRT). 2nd edition*. Educational Testing Service.

Wittmann, E. Ch. (2015). Das systemische Konzept von Mathe 2000+ zur Förderung „rechenschwacher“ Kinder. In H. Schäfer & Ch. Rittmeyer (Hrsg.), *Handbuch Inklusive Diagnostik* (S. 199–213). Beltz.