-- Three Activities --
My Dream Car, Marble Runs, Tower Building

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Hands-on activities such as building and operating airplanes, cars, towers, bridges, and so on are intended to familiarize young learners with technical and iterative work. Part of this is learning that the steps learners take should be reflected on, again and again, as they move toward a goal and try to overcome obstacles. Throughout these activities, teachers emphasize several important ideas:

- We rarely know in advance exactly how we will achieve a goal.
- We need to test our ideas. Experimenting—trying something, observing what happens, and adjusting based on what we learn—is an effective tactic for reaching difficult goals.
- To truly learn from an experiment, it helps to write down both what we expect to happen and what actually happens, so we can compare the two.

Figure 1. Reflecting on predictions as a source of learning. (*Toyota Kata Practice Guide*)

To help students stay aware of the scientific pattern embedded in activities, they are asked the **Coaching/Reflection Questions Starter Kata** before each round of experimenting. These questions give the students a format for working as a team and for organizing & presenting updates of their efforts in a logical, scientific way:

Q1: What is your goal?
Q2: Where are you now?
- **What did you plan to try in your last step?**
- **What was the result?**
- **What did you learn?**

Q3: What is your current obstacle?
Q4: What is your next step?
Q5: When can we see what you learned?

This is a useful, scientific working pattern for team exercises, which too often fail to include iteration and practicing ways of communicating, participating, cooperating, and working toward a common goal. Just packing lessons with activities doesn't necessarily help students acquire scientific-thinking skills.

The **Coaching/Reflection Questions Starter Kata** is used in all of the following building and constructing activities. It and the **Experimenting Record Starter Kata** are easy to add to activities you may already be doing in your classroom; as frameworks that turn those activities and assignments into practice of scientific-thinking skill. Practicing scientific thinking patterns promotes more self-directed and therefore more motivated learning, and develops skills that extend far beyond the classroom. The Starter Kata are suited to almost all subject-matter areas and grade levels.

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Activity: MY DREAM CAR

In this activity, students build functioning model cars using household materials like shoe boxes, pencils, votive candles, etc. (Figure 2). After describing the basic elements of a car – such as axle, body, wheels, etc. – the class works together to define the characteristics of a successfully functioning model car. These ideas are recorded on the board and become the Target Condition that all students aim for as they build their own “dream car” (see Figure 3).

With the help of the Coaching/Reflection Questions Starter Kata and "DMV inspections," progress is repeatedly reflected upon as the students work. Although all teams share the same Target Condition, each team can independently experiment on their own car at their own pace.

Notice how although this activity involves constructing a functioning car, students are also practicing a scientific-thinking pattern. Once internalized, this metacognitive skill can be transferred to many different situations, helping students approach challenges and problem-solving with confidence and curiosity.

Figure 2. Building dream cars.

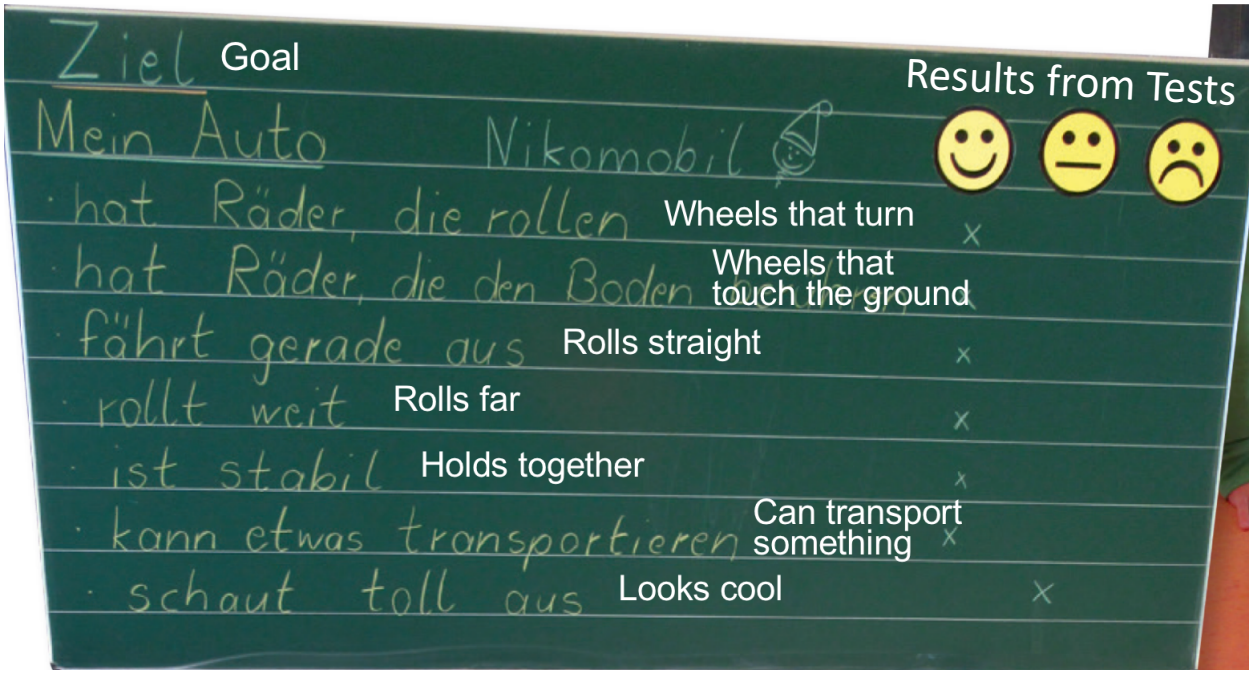

Figure 3. Example target condition & reflections on experiments, in the "Dream Car" activity.

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Activity: MAKING MARBLE RUNS

In this activity, students construct marble runs using magnetic track modules.

Goal: Build a marble run that is as long and tall as possible.

- The marble run should be stable and able to stand on its own.
- A marble should travel smoothly through all ramps and curves and come to a stop at the end.

Time: Plan for about 10 minutes per experimenting round.

Students work in teams, which makes clear communication and reasoning especially important. Establishing specific team roles—such as materials manager, timer, recorder, noise-level monitor, and presenter—helps keep groups focused and productive. After each experimenting round, teams record their responses to the Coaching/Reflection Questions on a simple worksheet (an example is included with these instructions). In first- and second-grade classrooms, the educator can support students by completing the written reflections on their behalf.

This is another good example of how adding a KiC Starter Kata or two turns an activity into practice of scientific thinking. By itself, constructing marble runs is a fun team-building exercise, but it does not automatically teach scientific habits of mind.

Figure 4. A student team working on their marble run.

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Activity: TOWER BUILDING

Building towers of paper and other materials works superbly with the KiC Starter Kata.

Objective: Construct a tower that is as tall and as stable as possible (Figure 5).

A key here is that the student teams are competing with themselves, not against one another. Their goal is to improve their tower through repeated iterations and experiments. One way to foster this is to run multiple rounds and have the teams track how the height of *their* tower changes over the rounds. The Experimenting Record Starter Kata works well for this kind of documentation.

The working procedure and documentation of experimenting cycles is essentially the same as in the previous activities. This repetition helps highlight the underlying scientific-thinking pattern and builds students' comfort with it. As students develop this awareness, they can more readily approach any goal or problem scientifically. It's not just about the tower, it's about helping students build skills and habits of inquiry, iteration, and evidence-based decision making, which they can apply across subjects and to real-world challenges.

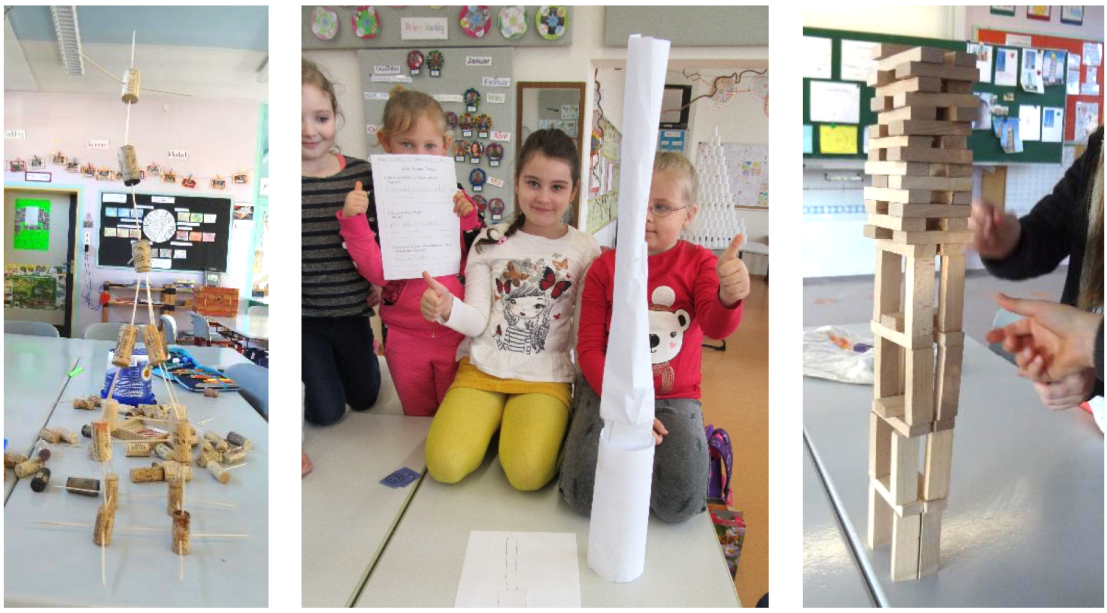

Figure 5. Building towers out of various materials.

Building a Marble Run

Goal: Build a marble run that is as tall and long as possible.

Characteristics:
- Your marble run should be stable and stay upright.
- A marble should roll all the way through the ramps and curves and stop at the end.

Time: 10 minutes per experimenting round.

Team: _____

1st EXPERIMENT:

What is your first step? _____

What was the result? _____

What did you learn? _____

Based on that, what is your next step? _____

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2nd EXPERIMENT:

What was the result of the 2nd experiment? _____

What did you learn? _____

Based on that, what is your next step? _____

_____

3rd EXPERIMENT:

What was the result of the 3rd experiment? _____

What did you learn? _____

Do you need to do another experiment? If yes, what is your next step?

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