"It's wonderful when students outperform their teachers!"

Interview by Eveline von Arx
August 10, 2016

Eveline von Arx: *How should tasks be presented to students in the classroom?*

Dieter Rüttimann: In a way that makes students eager to tackle them! There should be a problem to solve. For example, two things may differ for reasons that are not readily apparent, and students need to find out why. So a task should be motivating. The students will then carefully work through the problem, which leads to understanding and the problem's application to other contexts.

Studies have shown that instructional methods – a teacher-focused format or group S, for example – make much less difference for student learning than the quality of the tasks they are assigned.

EvA: *Are tasks particularly motivating when they relate to students and their needs?*

DR: Not necessarily. But it is certainly helpful to build on what students have already learned. New information is more readily retained when it is related to existing knowledge. However, not every task needs to be directly connected to children's lives in order to capture their imagination.

EvA: *Could you give us an example?*

DR: In my middle-school classes (ages 9 to 12), we learn about Platonic solids. When the topic is cubes, for example, I ask the students to imagine a point in the middle of each surface, and to connect those six points within the cube. Then I pose this question: What new solid would result from filling in those connecting lines with a surface?

EvA: *How do you help your students approach such an abstract problem?*

DR: The first step is usually to have them draw and construct the Platonic solids. This demonstrates how a cube and an octahedron differ, for example. They become increasingly interested in the topic as they draw and construct these solids.

EvA: *What possible types of tasks are there?*

DR: Some are traditional problems where a certain linking element is missing and must be identified. Hans Aebli, an expert in the psychology of learning, gives this example: The student is presented with a picture of a bend in the Rhine where a power plant is to be erected. The question is precisely where it should be built.

Another kind of problem involves a contrast: I show the children the skulls of a crocodile and a horse. Although they are approximately the same size, they are fundamentally different. The children have to find the reasons why. And then there are tasks that call for thinking outside the box: They might be asked to construct four equilateral triangles using six matches, for instance. The solution requires taking advantage of the third dimension to create a tetrahedron.

“A creative approach to problem solving will be increasingly important for our society.”

EvA: *Is it a good idea for teachers to provide hints to a problem’s solution?*

DR: They shouldn’t do so unless the students have obviously reached a dead end, despite communicating with one another. When their frustration is palpable. At that point I will provide a hint, or in the matches example I mentioned before, I might suggest that they expand their thinking beyond two dimensions. Above all, a good task should encourage students to think for themselves and solve problems independently. It is usually a good idea for them to work in pairs or small groups; this generates high-quality cooperative work.

Brain researcher Gerhard Roth has pointed out that the human brain is made to solve problems. Over and over again, I have seen how motivated students are by the “eureka!” experience that results when they succeed in solving a problem. Schools need to give children ample opportunities to solve challenging problems. We mustn’t underestimate how gratifying it is for students to think for themselves and solve problems on their own. If I let two weeks go by without asking my students to solve a problem like those I’ve described, they’ll ask me to give them another brainteaser.

EvA: *Isn’t it possible to create this sort of “eureka!” experience when the teacher stands in front of the class and demonstrates how the problem can be solved?*

DR: Not really. If I merely tell my students that something is true, they pay much less attention than when they have to discover it on their own. They will also remember things better if they come to understand them through their own efforts. In the future, a creative approach to problem solving will be increasingly important for our society. We will need more people who are capable of identifying a problem, exploring it intellectually, and then solving it. The schools will have to prepare children to meet that challenge.

Over the next few years, considerable resources will have to be invested in formulating well thought-out, subject-specific tasks that can be solved in a number of different ways. Remember, too, that not every student needs to achieve the same level of understanding. Another characteristic of a good task, after all, is that it can be understood at a variety of levels.

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EvA: *An elderly man once told me that he still has a good knowledge of Latin because it was drummed into his head over a period of many years. He was forced to memorize vocabulary and study grammar. Isn’t a certain routine – that is, a kind of learning that allows the student to produce the desired response automatically – necessary for successful learning as well?*

DR: Both are important – comprehension as well as practice. When you’re learning the multiplication tables, for example, you should eventually gain a sense of a kind of “numerical network”: If you know that 10 x 7 is 70, then you can deduce that 5 x 7 is half of that, or 35. You can’t draw such conclusions if you simply learn things by heart. So it’s helpful to understand the multiplication tables, but also to have an increasingly automatic ability to do simple arithmetic. This frees up your capacity to solve the core mathematical problem.

When children taking the secondary school admission test have to spend too much time on simple arithmetic calculations, they will not have enough time to solve the more complex problems posed to them. They'll find themselves preoccupied with peripheral processes rather than focusing on the actual problem at hand. Practice and training free up our mental capacity for carrying out higher-ranking processes. Today we know that problem-oriented tasks, coupled with practice and training, lead to high-quality results.

EvA: *You mentioned the importance of communication – students working together to solve a problem. What does that mean for the teacher?*

DR: It certainly means that the teacher needs to be open to such communication and cooperative thinking.

EvA: *Even when the teacher already knows where it will lead, and what the solution is?*

DR: I have seen students engage in discussions that are so creative, and at such a high level, that I was no longer able to follow their reasoning. I would never have arrived at the solutions they found. That is incredibly gratifying – there's nothing better than having students outperform their teachers.

Dieter Rüttimann is an education researcher, primary school teacher and principal of Gesamtschule Unterstrass (Unterstrass Comprehensive School) in Zurich, Switzerland. Gesamtschule Unterstrass in Zurich received the 2015 Klaus J. Jacobs Best Practice Prize in recognition of its "Self-Management and Socially Responsible Action" project.

Dieter Rüttimann also teaches basic and advanced training courses for teachers. For many years he has studied how children perceive and learn, and how to stimulate and promote the relevant processes.