"Students should work more on an interdisciplinary project basis"

Interview by Caroline Smrstik Gentner
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Digitalizing technology and design class in lower secondary school offers great potential for linking up math, language, and handicrafts skills, says technology and design teacher Rolf Beck, but there needs to be better interdisciplinary collaboration with other subjects.

Caroline Smrstik Gentner: *What motivated you to introduce circuit boards into your technology and design classes in a lower secondary school in Switzerland?*

Rolf Beck: I wanted computer science to become part of the technical design in student projects. With our modified Arduino circuit boards, the students learn the basic principles of hardware informatics and how to use sensors. (ed. note: Arduino is an open-source electronics platform, designed to make electronics and programming more accessible to anyone interested in creating interactive objects.) Each project always has an analog and a digital part and the learners themselves decide how much analog and how much digital they want.

With this combination, we can convey basic thinking about digitization. The power of a computer program is enormous, and the students know that, so it's interesting for them. It's important to me that the programming itself, not just the object design, has to involve creativity and aesthetic imagination.

What's unique about technology and design classes is that we walk through an entire process: from an idea to a sketch; then measurements and materials planning; the actual construction process; then programming and testing it out. I talk with the students about quality and about the risks involved if the final product doesn't work as expected, and I make entrepreneurial thinking part of the task.

CSG: *To encourage this way of working with students, you developed a processor-controlled learning environment, the PGLU. Does this learning environment support more than just a single project phase?*

RB: Yes, it's an ongoing process. The students work cooperatively and individually: their work develops over time because they look at what they or others have done earlier, then develop those ideas further. Their ambition to produce something takes on its own momentum and it becomes something where I don't have to direct each step.

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In general, I find the students have a great deal of inner motivation when they're working here in the shop, because they have a goal that they've set themselves and it really spurs them on.

CSG: *Technology and design class is required in lower secondary school in Switzerland. It doesn't have the reputation as a subject for "brainy kids," yet it's gaining in complexity. What needs to change?*

RB: I think our subject should be better integrated in the school curriculum. Students should work more on an interdisciplinary project basis: for example, partly in the workshop and partly with the math teacher, since there's a lot of mathematics in the programming we're using.

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There's the cliché that students who aren't so strong with their heads (math) are better with their hands (technology and design) – and that's just not true. These are complementary skills. In technology and design, you can come up with an idea, set a thought process in motion, and then eventually materialize the idea and create something. There's not enough of that in the schools. Our subject matter is just too isolated.

CSG: *Don't the new 21st century school curricula have anything to say about technology and design?*

RB: There is a lot of innovation going on, freeing up schedules and lesson plans for more interdisciplinary, project-based learning. That's good, but it's not enough. We need more of a mindset change among the teachers. We have to know more about each other and understand what the others are teaching. This shared basis starts in teacher training: technology and design teachers need to know more about mathematics, for example, and language. This is not covered strongly enough, in my opinion.

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There are exercises in the PGLU that are language-based: describe a process, or find key words for your programming. To understand the concept of key words, which is a necessary skill for the 21st century, students must have a good grasp of language and understand the context. Often, I advise my students to work with their language teacher on these exercises, but it's hard to motivate language teachers to analyze a technical text with their students.

That is a missed opportunity. There's so much learning that can happen when students and teachers work together to develop an understanding for something new.

Rolf Beck teaches technology and design at the Pfaffechappe lower secondary school in Baden, Switzerland, and developed the PGLU processor-controlled learning environment. The project is one of the Spotlight Switzerland 2019 award winners.

The **Pfaffechappe lower secondary school** is a three-year public school that prepares its 350 students aged 12 to 16 for vocational training, a challenging apprenticeship, or further education.

PGLU (*Prozessor-gesteuerte Lernumgebung*) is a processor-controlled learning environment developed for use in the technology and design course at the lower secondary school level. The modified Arduino circuit boards allow students to connect things and operate them, bridging the divide between analog and digital handicrafts. The students combine programming, industrial handicrafts, mathematics, and language skills in designing and building their objects.

PGLU was one of the ten **Spotlight Switzerland** projects presented at the **HundrED Campus Seminar** on 30 October 2019 in Zurich. The prizewinning projects highlight emerging best practices for digital transformation in the schools. The initiative is a collaboration between We Are Play Lab Foundation, Gebert Rüf Stiftung, Jacobs Foundation, Stiftung Mercator Schweiz, Beisheim Stiftung, digitalswitzerland next generation, and the Zurich University of Teacher Education.

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