R&E-SOURCE http://journal.ph-noe.ac.at
Open Online Journal for Research and Education
Special Issue #8, September 2017, ISSN: 2313-1640

International Week 2017 in Melk, May 29th to June 02nd

SteAm (Science – Technology – Engineering – Arts – Mathematics) in Education Inquiry Learning across the Curriculum

*Erwin Rauscher**

Abstract

This is the synopsis of a keynote for the opening at the Campus Melk. However, the spoken word applies!

When the green snake *"… in the clefts of the rocks where she dwelled with wonder and awe, she raised her eyes to an illumined niche, in which stood the statue of a venerable King … Scarcely had the Snake beheld this venerable form, than the King found utterance, and said, 'How comest thou hither?' 'Through the cleft in which the gold abides,' answered the Snake. 'What is nobler than gold?' asked the King. 'Light,' replied the Snake. 'And what is more vivid than light?' continued the King. 'Speech,' said the Snake."*

My very warm WELCOME to all of you coming from so many countries, especially from so far in the United States. Why am I telling you these words from the famous fairy tale about "*the green snake*" at the beginning of this international week? From a novel by the number 1 of German poets, Johann Wolfgang von Goethe?

One reason, dear Kurt might be, that I am a bit angry with you. Largely because you entitled the international week using the word STEAM. We know that steam is "hot air" which in some sense is the opposite of hard work. Now for a week heads will smoke. However on such a lovely summer day as today we should appreciate that steam is only water that at heat is made to "dust." Or after an old teacher that today blows off a lot of steam so that he himself doesn't fade away as steam would. My dear Kurt, teachers who constantly get the steam up and forget how to maintain the pressure of the job only produce a lot of hot air. Does STEAM, therefore, represent nothing else than a week cooking with water and in that process producing a lot of steam? A stream that ignores its origins dissolves long before the estuary in the form of Steam. But perhaps, dear Kurt, with your acronym for science you tried to address something, that scientific thinking and acting asks for in school, I – much simpler – refer to it without an acronym, but for school lessons as Goethe said: gold, light and discussion.

With gold and light and under discussion scientific subjects today define themselves in the broader field of research and society. The gold of knowing facts is embedded in the light of experience and the dialogue between teachers and students. The transmission of subject matter knowledge is combined with recognition and individual awareness, taught and connected with communication and evaluation. Since, in order to make their way in today's world, to understand humanity and nature, our students not only adapt themselves: they question the world, ask for explanation and justification.

Young children want to adopt the world. They want to know why the sky is blue, if animals can think and feel, why it rains, why flowers grow and why is there a day and a night. Children ask why and how come. Children who don't ask questions yawn more than they liven up. Not the answers but rather the questions become their form of speech, in order to set in motion a cognitive process leading to knowledge. The sea is fed by the stream, which does not vaporize in school, but flows into life. The sum of the questions is the learning environment school. And because STEAM as acronym attempts to cover the natural sciences and arts, I provide my examples as simple children questions:

* Univ.-Prof. MMag. DDr. Erwin Rauscher is the Rector of Pädagogische Hochschule Niederösterreich, Mühlgasse 67, 2500 Baden. *E-mail:* erwin.rauscher@ph-noe.ac.at

Water is colorless – but why does our wet hair appear darker? Similarly, by the way, like wet sand! That is "optics" from a child's mouth. But why does the dark sand become light when we stand on it? Or: at this time of the year: children love strawberries with sugar. But why do these swim around so rapidly in their own juice? That is "physics" from a child's mouth. Or: why does mineral water bubble and why does fire crackle? That is chemistry from a child's mouth. Why does our stomach make noise? That is not only biology from a child's mouth. Why is 1 plus 1 sometimes equal to 2? And other times equal to 1 0? That's a question between mathematics and computer science from a child's mouth.

In the mathematical interpretation it is an addition of two parameters – some discourse about a problem. In mathematics we deal with the past – without its historical development the Egyptian people would not have been able to build pyramids. And, in mathematics we also deal with the future – without mathematics our modern information technology would not exist. In other words … instead of being able to fly to the moon, we would be still behind the times. But why do beard stubbles become soft after three days only? This is a question posed by adults only …

What do we have to do in order to make schools houses for little explorers who aim to calibrate the world? … in their natural approach we should aim at creating knowledge, in a way that through the students' curiosity, specific knowledge and consistent behavior is derived. In order to actually calibrate the world, Daniel Kehlmann's famous novel is needed as obligatory lecture in Europe's schools as well as a certain regulation – which are principles in mathematical science.

However, we have to be cautious: Heinrich Faust at Goethe tries to figure out "what holds the world together in its middle"… who does not know this part of one of the worlds' greatest masterpieces, cannot be said to be highly educated in Austria. On the other hand, those who do not really know whether there is dark matter or antimatter (in spherical astronomy), consider themselves to be well-educated. School has to cover it all – leading into the endless universe and the hidden realm of elementary particles as well.

Americans may be one step ahead of us Austrians in some scientific questions like the latter one. But, if you plan to visit these beautiful gardens of the monastery of Melk in summer, you should try to imagine an Austrian and an American teacher in these gardens while a child comes by asking them how any respective tree next to them is called … The Austrian teacher is going to take out a book about botany and starts thumbing through the book. The American teacher, however, goes and asks the gardener.

In physics we know about a so-called "Fermi-question", named after the nuclear physicist and Nobel prize winner Enrico Fermi, who was able to find a quantitative approach to a problem in next to no time, even though there was no data available so far. Enrico Fermi threw paper scraps into the air before the first test of nuclear bombs in the USA and figured how far they are blown away by the compression wave: therewith he was able to give an estimation of the bombs' blasting force. So let us wish to have some paper scraps which help to avoid bombs.

Nevertheless, I think that children's questions require quite a lot accuracy when being answered. This, however I would like to point out through a little story: A physicist – on his way home at the beginning of his vacation – was passing by the wide meadows of his father's farm, before he was asked by his father, who got him from the train, whether the sheep on the meadows had already been sheared. The physicist answered: *"not on the side facing towards me".*

So, before I stop talking there is some other little anecdote: Once upon a time there was a man who wanted to build a new boomerang. But he was not able to throw away his old one …

Dear colleagues from all over the world: By the time and age, speeches get longer, but breath gets shorter: And before I am running out of steam and before you all let off your steam against me because of my bad English, I will end this speech now … and I wish you all a good time with good people and maybe new friends here in Austria… and a great steaming week!