

## The MST curricula in teachers' and learners' perceptions as an illustration of the SECURE project outcomes

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### Abstract

We report on preliminary results of the SECURE project (Science Education Curriculum Research), which is ending in October 2013. In the project a comparative cross-country curriculum research in a consortium of ten European states is performed. The focus of the project is on three aspects of the mathematics, science, and technology (MST) curricula and their objectives in view of balancing the needs between training future scientists and broader societal needs. Three aspects of the MST curricula are explored: what is written in the curricula (i.e. *intended*), how the curricula are translated by the teachers into everyday practice (i.e. *implemented*), and how the curricula are perceived by the learners. The research is implemented in all consortium states in altogether around 150 classes of each of the four learners' age groups (5, 8, 11, and 13 year old pupils). The data is collected at the national level by summarizing national curricular documents, teachers' and learners' questionnaires, and interviewing all teachers and about four learners in 6 out of 15 classes for each age group in each country.

In the paper the findings of a comparative analysis at all three levels of a few curriculum related items are presented as an illustration of the final project outcomes. We restrain the results to 2 out of 11 studied curricular elements: Learning activities and Grouping. The first serves as an example of a complex research item with a large diversity over countries and ages, while the second one is an example of a rather simple to analyse yet important segment of how the curriculum is understood and executed in different countries.

### Extended abstract

The SECURE (Science Education Curriculum Research) project is founded as a collaborative project of ten countries (Austria, Belgium, Cyprus, Germany, Italy, Poland, Slovenia, Sweden, the Netherlands, and the United Kingdom) under the FP7. It is providing research results of current mathematics, science and technology (MST) curricula across Europe. In the presented study some of the preliminary results are reported with the emphasis on illustrating the final outcomes of the project on one side and illuminating a few interesting findings of the present stage of the project on the other side.

SECURE is tackling the MST curricula from three different points of view with an overall aim to formulate a set of recommendations for policy makers and other stakeholders on how MST curricula and their implementation can be enhanced. In particular, the search on how to provide a sustainable balance between the needs to train future scientists as well as to address broader societal needs. The three explored aspects of the MST curricula are the written (i.e. *intended*) curricula, the curricula as understood and executed by the teachers that carry out the educational process (i.e. *implemented* curricula), and the opinions and feelings about the MST learning procedure of the learners (i.e. *attained* curricula). The back bone of the research is the curricular spider web introduced by van den Akker (2003) that is employed at all three

aspects. In order to get vertical as well as horizontal insight across all partner countries, the research is done on four age groups, comprising 5, 8, 11, and 13 year olds and the MST teachers of all four age groups. Each of the spider web elements (Rationale, Aim and Objectives, Content, Learning activities, Teacher role, Materials and Resources, Grouping, Location, Time, Assessment) is analysed and an additional element Motivation and Interest is added, because it is not included in the original spider web and on the other hand it is evident that it might play an important role in teachers' and learners' execution as well as perception of the curriculum. In cases of the 5 and 8 year old children all MST subjects are usually taught by a single teacher who spends all or most of the time in a single class. In cases of 11 and 13 year old pupils there is usually one teacher per one MST subject, in some instances one teacher is teaching more than one subject, but in some countries there are several subjects that all together constitute one of the MST elements, e.g. Chemistry, Biology, and Physics represent "Science" for the 11 or 13 year old pupils. On the other hand it is not possible to distinguish between the different MST subjects for the pupils aged 5.

The data is collected at the national level in 15 classes for each age group per country. Depending on the country the pupils of different age groups are either in different schools (e.g. 5 in kindergarten, 8 in primary, 11 and 13 in lower secondary in Germany) or partly in the same school (e.g. 5, 8, and 11 in primary and 13 in lower secondary in Belgium). Whatever the case, for all 15 classes the teachers and the learners of each age group were answering to the extensive questionnaires adopted to different age groups. To further clarify the findings another research instrument was developed giving the guidelines for semi-structured interviews. The instrument is used in 6 classes. All MST teachers and around four learners (ideally 2 boys and 2 girls) per each age group participated in the interviews. The teachers were interviewed individually or in small groups, while each age group of learners was interviewed as a separate group.

In the paper a comparative cross-country analysis related to the two spider web elements is presented. The Grouping serves as an item, which is relatively easy to elaborate on. By grouping we mean basically answering the question "With whom are the learners learning?". The most obvious possibilities include "alone", "in a small group of peers", "together with the entire class", etc. On top of the size of the group the composition of the group is an important element, e.g. boys/girls, high/low achievers, motivated/non-motivated pupils, etc. Least but not last, we are curious about the merging of learner groups either of different ages or from different schools, etc. The answers are searched for in official curricular documents in order to detect, what is the intended way of learning process with respect to grouping. In the questionnaires the frequency of anticipated grouping activities is addressed and during the interviews the topic is additionally illuminated with opinions and facts by teachers and learners. Differences and similarities across the ten countries exist and will be presented and evaluated in the presentation.

The Learning activities serve as a more complex example with larger variations over age groups and countries. On the other hand the variety of intended and implemented activities, together with the teachers' and learners' opinions about these activities acts as a pond of ideas for future enrichment of MST education curricula in all partner countries and in other European countries. The key question related to Learning activities is "How are the learners learning?". Again the first insight is obtained from the official curricular documents and the anticipated answers include "teaching ex cathedra", "conduct experiments", "showing demonstration experiments", "solving problems", etc. The implemented and attained activities are searched for in interviews and questionnaires. The main separation of the activities that we are interested in is into activities they actually do and activities they would ideally do. On top

of this we want to know about activities they cannot do and the reasons for such situation. Each mentioned activity is further classified as minds-on, hands-on or non-active. In the presentation preliminary results emerging from all three levels of the SECURE research will be evaluated. An example of the existing diversity between the ten countries is the activity called the Activity days (up to seven MST days per school year). In Slovenia it is so well incorporated for so long in the official curricula and in the teachers' and learners' minds that everybody is taking it as self-evident. The teachers mention the Activity days – a whole day dedicated, for example, to Science or Technology – and their beneficial existence for certain Learning activities such as interdisciplinary investigation or working in groups on a more extensive problem, but they do not seem excited about their existence in the system. On the other hand in other partner countries this form of Activity is hardly known and rarely used, but it can be indirectly detected that the teachers feel the need for such an activity, because they give examples of what they cannot do. Some of these examples fit nicely into the Activity day framework.

With the above presentation we intend to illustrate the character of the final SECURE outcomes, which are to be also recommendations on MST curricula of general and particular nature, always having in mind their objectives: balancing the needs between training future scientists and broader societal needs.

### **Acknowledgement**

This research was supported by SECURE Project No SIS-CT-2010-266640 under the 7th Framework Program funded by European Commission.

### **Reference**

van den Akker, J. (2003). Curriculum perspectives: An introduction. In J. van den Akker, W. Kuiper, U. Hameyer (Eds.), *Curriculum landscapes and trends* (pp. 1-10). Dordrecht: Kluwer Academic Publishers.