ESERA2013

Proposal view

Proposal Type:	Symposium
Strand:	10. Science curriculum and educational policy
SIG:	N/A
Scheduling category:	Curriculum
Type	Submitted Symposium
Title	Researching mathematics, science and technology curricula across Europe: A mixed methods approach

Abstract

The SECURE-project (Science Education Curriculum Research, FP7) makes a significant contribution to the European knowledge-based society by providing relevant research data that can help to improve MST curricula and their implementation throughout the EU. The research focuses on the MST curricula offered to 5, 8, 11 and 13 year old learners in 10 European countries.

This symposium presents and discusses the research results of the mixed method approach for the analysis of the MST curricula, which is applied throughout 3 different representations of the curriculum: the *intended curriculum* (formal curriculum documents), the *implemented* curriculum (the actual process of teaching) and the *attained curriculum* (focus on learning experiences of the learners).

The first presentation gives an overview of the mixed-method research framework and focuses on general trends in the research results and cutting-issues that have been encountered in the cross-country analysis of the MST curricula.

The second presentation is directed towards the intended curriculum and underpins the results of the cross-country qualitative analysis of the collected formal curriculum documents from all 10 countries. The curriculum screening instrument was designed to detect, describe and evaluate commonalities and differences among the formal curricula, which testify of a wide range of different approaches and designs, influenced by diverse cultural, systemic, educational characteristics of the members states.

Both the third and the fourth presentation open a double-country perspective (Austria-Cyprus, Italy-Poland) on the implemented and attained curriculum within the praxis of the schools. In focussing on the results of questionnaires and interviews, which record the experiences of the learners and the teachers, similarities and differences between the countries are compared, related to the country-specific educational contexts and evaluated.

The discussion on the crucial issues will be initiated and stimulated by the critical reflections of the co-referent of the symposium.

Equipment	Overhead projector Data projector / beamer
Keywords	Curriculum Student Interest Teacher Thinking

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Paper Details

Paper type Empirical

Title Intended, implemented and attained MST curricula across Europe: What can research tell us?

Abstract

The SECURE project has been founded under the 7th Framework Programme to provide research results of current mathematics, science and technology (MST) curricula across Europe. The overall aim of the SECURE is to make a significant contribution to the European knowledge-based society by providing relevant research data and translate them into recommendations that contribute to the public debates on MST curricula and their objectives in view of balancing the needs between training future scientists and broader societal needs. A rigorous research program conducted by the SECURE consortium scrutinizes and compares current MST curricula for pupils aged 5,8,11 and 13 in ten member states, as they are intended by the authorities (legal documents), implemented by the teachers and perceived by the learners. The research at all three levels is designed in accordance to the curricular spider web (van den Akker, 2003). The instruments used consist of a transnational comparative screening instrument for MST curricula, as well as school data collection instruments: teachers' and learners' questionnaires and interview protocols. Research in altogether almost 150 classes of each age has been done with involvement of ca. 9000 learners and 1500 teachers. Cross-country summary of national curricula documents and the analysis of the school collection data reveal a wide common ground in all 10 partner countries and some examples of good practices encountered in single countries, that can be implemented elsewhere to improve written curricula, to address teachers' perceptions and to enhance learners' motivation and interest in MST disciplines.

Summary

Rationale

SECURE is founded as a collaborative project under FP7 to provide research results of current mathematics, science and technology (MST) curricula across Europe. The overall aim of the SECURE project is to make a significant contribution to the European knowledge-based society by providing relevant research data that prompt public debates on these issues. Based on good practices and other research results SECURE will formulate a set of recommendations for policy makers and other stakeholders on how MST curricula and their delivery can be enhanced. These improvements would need to focus on encouraging and preparing children from an early age on for future careers in MST. At the same time curricula should make MST more accessible and enjoyable for all children so that they will always keep a vivid interest in mathematics, science and technology, understanding the importance of their societal role.

Theoretical Framework

Different meanings of "curriculum" can be found in different contexts of educational research (Taba, 1962; Jackson, 1992; Pinar, Reynolds, Slattery & Taubam, 1995; Walker, 2003). To get a complete overview of the curriculum, the analysis should be done at five different levels with respect to the curriculum users (van den Akker, 2003): Supra (international), Macro (national), (Meso (school, institute), Micro (classroom, teacher), Nano (pupil, individual). In 2003, van den Akker proposed curriculum representation on a spider web in which Rationale is located in the center and the nine other components (Aim and Objectives, Content, Learning activities, Teacher role, Materials and Resources, Grouping, Location, Time, Assessment) are placed around it, becoming the nine threads of the spider web, connected at five curriculum levels.

Objectives

The specific objective of the SECURE project is to provide relevant and rigorous research data and translate them into recommendations that contribute to the debate among policy makers on science curricula and their objectives: balancing the needs between training future scientists and broader societal needs.

The cores of the project are: the analysis, the comparison between the aims and the content of the current MST curricula in the member states; identification of shared grounds among existing MST curricula; identification of good practice in the member states; establishing how curricula are put into practice by MST teachers and how current curricula affect learners' competences, motivation and perception of the relevance of mathematics, science and technology.

Method

A total of 11 partners in 10 EU countries are involved in the project: Austria, Belgium, Cyprus, Germany, Italy, the Netherlands, Poland, Slovenia, Sweden and the UK.

The SECURE research is focused on 5, 8, 11 and 13 year old learners, their science curriculum and their teachers. The choice of these ages was done to investigate in a comparable way among the involved countries the bridges and the gaps that exist in curricula, on one hand - between kindergarten and primary school and, on the other hand - between primary and middle schools.

To ensure a profound view on the MST-curricula at the different levels, the research focuses on:

1. The formal intended MST-curriculum by comparing written MST curricula in the 10 participating EU countries. It was decided to focus on mathematics, technology and (natural) sciences (restricted to biology, chemistry and physics, physical geography).
2. The implemented MST-curriculum that takes into account the perceptions of teachers who put the curricula into practice in the day-to-day class activities.
3. The attained experiential curriculum, which focuses on the learning experiences of the pupils, the final and most important recipients of the MST-curriculum.

Data collection in schools took place in two phases: a pilot study, conducted only in four member countries (Germany, Italy, the Netherlands and the United Kingdom) and, then, the systematic, core studies. The pilot study involved a small number of classes and was performed to test and evaluate the first version of the school data collection instruments. After piloting, the instruments were redesigned and in all ten member countries the systematic collection of data in schools has been performed in 15 classes of each age group of learners. On the whole the amount of almost 600 classes, 1500 teachers of mathematics, science and technology, and 9000 learners have been involved in the study.

The research framework was constructed upon the curriculum spider web (van den Akker, 2003). The research instruments consist of curriculum screening instrument (CSI), and of the school data collection instruments: teacher questionnaires, learner questionnaires (limited to 8,11 and 13 year olds) and interview protocols for all age groups of pupils and their teachers.

Data and findings

Cross-country analysis of curriculum documents revealed a variety of approaches to the overall education and to MST subjects in particular. It also occurred that the systems of education are very much diverse across Europe. On the other hand analysis of the questionnaires and interviews showed a large similarity of teachers' and learners' perceptions on MST, their attitude to work and systemic problems encountered in implementation of the curricula in every-day practice (e.g. unbalanced curricular load vs. appropriated time). Emerging differences can be linked to the system and curriculum diversity as well as to the teacher education and professional development. It was also evidenced that, although a huge effort in introducing active learning methods is commonly made in all ten countries, both in written curricula documents and teachers' intentions, the frontal teaching, the work on one's own, learning by heart and assessment with written and oral tests are the most frequent experiences of the learners.

Along with that a combined analysis of data at three levels of curricula revealed the presence of quite a large number of good practices already implemented in some countries that could provide solutions to the deficiencies encountered elsewhere, in order to improve written curricula, to address teachers' perceptions and to enhance learners' motivation and interest in MST disciplines.

Conclusions

The triangulation and cross-country analysis is continued to find out more common grounds, essential differences and exemplary solutions used successfully in partner countries. The outcomes of this further analysis will be included in the presentation.

Acknowledgement

This work is based on the SECURE research project (No SIS-CT-2010-266640), which received funding from the European's Unions Seventh Framework Program for Research and Development.

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Keywords Curriculum
Student Interest
Teacher Thinking

Appendices

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Paper type Empirical

Title Mapping the curriculum for mathematics, science and technology education across Europe

Abstract

As part of the SECURE project on mathematics, science and technology education in 10 EU countries, a curriculum screening has taken place of the national curriculum documents in those countries. The analysis took place using the curricular spider's web as a framework (Thijs & van den Akker, 2009).

The spider's web provides a way to visualize the relationship between different curriculum aspects, each thread of the spider's web representing an aspect of learning.

The following components in the spider's web have been used in a first analysis of the national curriculum documents: Rationale, Aims and objectives, Content, Learning activities and teacher role, Materials and resources, Grouping, Location, Time, and Assessment. For each of the components the national curriculum documents have been screened, to see if references to these components are present in these documents, and if so, in which way. Furthermore, a cross-country comparison has been made for each of the components.

A further analysis will focus on (amongst others) the inclusion of EU key competences in the curriculum documents as well as on issues specific for MST education, including: science and engineering practices (e.g. developing models and the use of these), cross-cutting ideas, argumentation in science, and practical work (design of experiments, planning and carrying out investigations). Results of this further analysis will be included in the presentation.

Summary

Theoretical Framework

The curriculum documents have been analysed using the curricular spider's web as an analysis framework. The spider's web provides a way to visualize the relationship between different curriculum aspects. The core and each thread of the spider's web represent an aspect of learning and the learning programme for pupils (Thijs & van den Akker, 2009). The following components in the spider's web have been used in a first analysis of the national curriculum documents.

A variety of curriculum documents for Mathematics, Science and Technology (MST) exists in the partner countries. A first analysis of the available curriculum documents show that there is a great variety of in the number of curriculum documents in the 10 partner countries, as well as in the number of pages each of these documents contain, from just 12 pages presenting the core goals for lower secondary education in the Netherlands, to documents with several hundred of pages.

Results

Below are presented the results of this analysis, for each of the spider web components.

Rationale –

In general terms the rationale in the MST curricula for 5, 8, 11 and 13 year olds seem to focus on three (interrelated) issues:

1. Acquisition and promotion of social skills, identity and participation

2. Acquisition of knowledge, cognitive skills, and scientific literacy
3. Broader societal needs, moral/ethical, sociopolitical, critical/creative, environmental aspects.

Aims and objectives

Aims and objectives have been formulated per age group, or in a combination of age groups, e.g. combined in primary education, compulsory school, or middle school. In some countries, these objectives are formulated as 'goals to attain' and 'goals to strive for'. They are obligatory, but not necessarily tested.

A majority of countries have aims and objectives formulated for learners of 5 year olds in kindergarten or pre-primary school. Focus is hereby mostly on 'soft skills', linked to 'discovery in the familiar surroundings'. During primary school and into lower secondary (age groups 8,11 and 13 year olds) aims and objectives focus increasingly on separate MST subjects, biology, physics, chemistry, whereas initially these were combined in larger learning areas, such as 'World orientation' or 'science' in primary schools. All countries pay attention to vertical alignment.

Content

The way in which the content is described in the curriculum documents varies per country: from broad descriptions, e.g. in Sweden and Netherlands, to very detailed in other countries (e.g. Poland and Germany). Similar to the aims and objectives, the content seems increasingly presented in separate subjects when moving up through the age groups. There seems a great similarity in MST topics that are mentioned in the curriculum documents of the partners. In the documents three focal areas seem apparent: focus on learning areas and subjects, on coherence, and on relevance in daily life. The latter is seen as important for various reasons: motivation of student, general principle of education, preparing pupils to live their life in the world, and continuation to the next educational field.

Learning activities and teacher role

In a majority of countries pedagogical principles are included in the curriculum documents, both in general terms and for MST education specifically. Three countries do not have such principles included, as these are considered for schools and teachers to make decisions about. Active learning, cooperative and coherent learning are highlighted, as are 'activating methodologies', 'the importance of group work, partner work and modern learning strategies', organizing excursions, field trips, outdoor activities and 'to invite experts to enrich the lectures'.

In some cases very specific guidelines are formulated about chemistry experiments (e.g. in Poland at least 25 experiments) with special attention to teaching about the process of doing research. For physics it is stated that experiments need to be carried out by students in groups with particular attention to the sequence of activities in the research process (from hypothesis to drawing conclusions).

Materials and resources

Core curriculum documents do not prescribe explicitly which materials should be used. But they are implicitly recommended in the learning activities described in the curriculum documents. The use of subject-related devices and instruments (such as microscopes, computers, mechanical or electric tools) is observed in curriculum documents in some countries.

Assessment

The assessment procedure seems different from one country to another. In all countries teachers play an important role in the assessment procedure. Criteria for MST-assessment are described in knowledge or developmental skills, in either attainment targets or goals and except in 2 countries, these are valid for all ages. Assessment activities are formative and used to follow pupils' development. In four countries evaluation is carried out under the auspices of a national or municipal examination board. There is a tendency that results of the exams are given in marks from 8 years and older, and that they are descriptive for the younger (5 or 8 year olds). In some countries the information to parents about the outcome of assessments is explicitly mentioned.

Time

In most countries, time for the various MST subjects is indicated in the curriculum documents. This varies across countries from general to very specific. Usually timetables for MST for 5 years old pupils are not included.

Location

For natural sciences and technology (as well as geography) in some countries it is implicitly described to use locations different from the regular classroom, such as a laboratory or outdoor activities in the (natural) environment.

Grouping

Less attention is paid in the national curriculum documents to grouping procedures. Some suggestions are found and these are concerned with smaller groups in crafts or technology lessons or experimental work. In most countries the number of pupils per classroom is indicated.

Further analysis

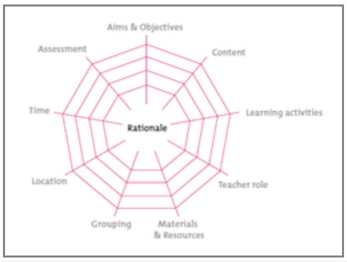
Further analysis will focus on the occurrence in the available national curriculum documents of the EU key competences and more specifically on references to issues in MST such as science and engineering practices (e.g. developing models and the use of these), cross-cutting ideas, argumentation in science, and practical work (design of experiments, planning and carrying out investigations). Results of this further analysis will be included in the presentation.

References

Thijs, A & van den Akker, J. (2009). *Curriculum in development*. Enschede: SLO.

Keywords Curriculum

Appendices



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Paper type Empirical

Title Perceptions of teachers and learners about the mathematics, science and technology curricula in two European countries

Abstract

We describe how teachers and learners perceive the Mathematics, Science and Technology (MST) curricula they are engaging with in two different educational systems, those of Austria and Cyprus. Curricula are significant policy statements that often intend to provide binding specifications on teaching priorities or anticipated learning outcomes. They function as guidelines for the creation of teaching-learning resources, for setting the approach and emphases of assessment and for framing the efforts and practices of teachers. The Austrian curriculum documents have a descriptive character and lay emphasis on the process of learning, whereas the Cypriot curriculum documents are more specific and content oriented. The main purpose of our study was to examine, through a mixed-methods approach, the existing MST curricula as interpreted by their users, mainly teachers, and as experienced by the students. We have analyzed the data – collected through interviews and questionnaires - on the basis of curricular spider-web components, as formulated by the model of van den Akker (van den Akker, 2003). In our analysis, we focus on the perspectives and rationales of teachers and students on MST learning and their perceptions of aims and objectives of MST curricula. Their notions on how the curriculum is applied in the school context through learning activities and the way they understand their roles when engaging with these activities are also explored. Similarities and differences on the aforementioned aspects between the two different educational contexts of Austria and Cyprus are discussed in an effort to investigate the effect of the diverging nature of extent and specification of the published curriculum. Environmental aspects, such as materials and resources students and teachers have access to, along with the support structures of the educational systems such as professional development provisions, have an influence on the learning reality which must be taken into account when developing curricula.

Summary

Introduction

In this study, diversions between the educational systems of Austria and Cyprus on aspects like published curricula, the way teachers are trained, as well as materials and resources available for teaching practice are taken into account, in an effort to identify routes of differences and similarities on perceptions of teachers and learners between the two countries.

Methodology

Targeting learning at ages 5, 8, 11 and 13 years, we have worked with a sample of each 15 kindergartens, primary and lower secondary schools in both countries. Two cities and their suburbs as well as countryside schools were visited in Cyprus. To enable diversification in location, Austria focused on the province of Styria, with a third of visited schools being located in a city, town and the countryside. In a meeting with headmasters, participating classes were specified. Questionnaires for learners of 8, 11 and 13 years were completed with researchers present; teachers of all age groups and MST subjects in chosen classes were also given questionnaires. Additionally, learners and teachers from 6 schools per age were interviewed. Concerning kindergartens, learners of all 15 samples were talked to because of not using questionnaires. Learners were interviewed in groups of 4, 2 boys and 2 girls, teachers individually. For both semi-structured interview guidelines were used with questions related to all curriculum spider-web components (van den Akker, 2003), going into depth on issues targeted in the questionnaires as well. Transcripts were coded based on grounded theory according to a pre-set structure of categories related to the curriculum spider-web components. Preliminary results presented here were derived from the analysis of interviews and will be triangulated in the coming weeks with results from questionnaires.

Description of variations between the two educational systems

For kindergarten, teachers have to pass a five year vocational school on the level of secondary education in Austria, whereas a bachelor degree on general education is required in Cyprus, which also concerns primary school teachers in both countries. Teachers for lower secondary schools in Cyprus teach one subject only and must have a bachelor degree in their specific discipline, followed by obligatory one year courses on pedagogy and didactics at university before teaching in school. In Austria, teachers for secondary school either complete bachelor study at University of Teacher Education or attend a general university earning a master degree which also qualifies to teach in upper secondary schools, both involving content, didactic and pedagogy training. Learners enter lower secondary school when 10 years old in Austria and 12 years old in Cyprus. Textbooks for MST are provided by the Ministry of Education at all public schools in Cyprus whereas approbated textbooks and teaching aids in Austria are chosen from a list provided by the Ministry of Education by decision of teacher’s conferences at school level, considering opinions of parents’ representatives.

Results

In both countries, the majority of learners and teachers of all ages think MST to be an important part of education and learners’ development as individuals. Though professional development seminars take place in both countries, there is need for more, with teachers asking for effective seminars with examples on practical approaches. Age group 5 teachers in Austria welcome the plan to establish kindergartens as elementary part of the educational system; Cypriot teachers feel that it is good that there is an update with the new curriculum and a new approach. These statements show that in both countries teachers care about the system’s evolution and their personal improvement.

In Cyprus, most of the teachers agree that aims and objectives are visible and comprehensible in curriculum documents, in Austria the majority of teachers agrees on them being general and formulated broadly and clearly. Certain specifications on how to reach goals are missed sometimes as the emphasis of the curriculum is explicit on the process of learning. However, there are teachers who prefer this freedom enabling them to choose objectives for their lessons. Despite the more descriptive character of the Austrian curriculum documents, teachers feel a similar commitment to cover the curriculum as teachers in Cyprus. Curricular load and appropriated time are not experienced as balanced which has a negative effect on implementation especially of practical approaches.

In both countries, most of the teachers think that the level of the curriculum is suitable for learners. An objection raised in the case of Cyprus is in the spiral organization of mathematics curriculum, causing some problems in teachers’ opinions which may be confounded by newly introduced curriculum innovations. In Austria, teachers seem to be more open to cross-curricular teaching. In Cyprus, especially at secondary schools, teachers coordinate with others teaching the same lesson in their school about which aims and objectives to emphasize, while in Austria except in the case of mathematics most of them act autonomously. These differences might be driven from the different training of the secondary education teachers in the two countries.

The strong content focus in the Cypriot curriculum can be seen among teachers, defining themselves mainly as instructors, strongly focusing on achieving aims. Apart from mathematics, many Austrian teachers set their priority on enthusing learners. In both countries, teachers feel responsible to connect content to learners’ everyday life to keep them motivated. Austrian teachers feel challenged when balancing low with highly interested or talented learners and deal with this individually. Whereas Cypriot teachers emphasize on weaker learners, average achievers are the main focus in Austria. Cypriot learners follow their special interests in voluntary extracurricular projects, in Austria those are followed mainly at home on own initiative, finding their way into class via learners’ presentations in science.

Teachers and learners of all ages and subjects in both countries highlight the motivating aspects of practical activities, which decrease with age in mathematics. When doing science experiments, Austrian teachers emphasize on learners working alone or in groups. Cypriot teachers demonstrate approximately half the experiments, the rest are carried out by learners in groups. This may be related to curriculum documents, where practical approach is encouraged in Austria and only implied into content in Cyprus. Learners like experimenting for its' own sake, but also emphasize that practical activities help them to understand better. Technology in Cyprus becomes theoretical for age group 13, resulting in a lower level of interest of learners; practical approach and learners' interest remain high in Austria.

Cypriot and Austrian teachers express the wish for smaller groups like the applied split classes in technology in both countries, as they feel experiments and responding to individual needs would be easier to implement. While Cypriot teachers of 8, 11 and 13 year olds say they let work learners in small groups when exercising mathematics problems or constructing in technology, Austrian learners usually work alone. Merging learners of different ages for activities is described as valuable for interest and understanding but only described for Austria with few existing examples.

In both countries, sympathy for the teacher influences learners' attitude towards subjects. Successful teaching for Cypriot teachers is mainly connected to make learners aware of the usefulness, Austrian teachers emphasize on enthusing learners for MST omnipresence.

According to preliminary results, differences in systems and curricula seem to effect teachers' and learners' perceptions and practice, remaining to be compounded through triangulation with questionnaire data.

Corbin, J. & Strauss, A. (1990). *Grounded theory: Research, procedures, canons, and evaluative criteria.* Qualitative Sociology 13 (1), 3-21.

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Keywords Curriculum
Student Interest
Teacher Thinking

Appendices

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Paper type Empirical

Title Questioning MST of curriculum in action at eleven year olds in Italy and Poland

Abstract

To provide recommendations based on research data to the debate concerning the development and the implementation of the curricula of Math, Science and Technology (MST) at European level, the teachers' perception and curricular implementation were investigated at school level using questionnaires and interviews. On the base of the data acquired by means of pilot studies held in Germany, Great Britain, Italy, and the Netherlands, it was decided to provide four different types of questionnaires: two for students and two for teachers.

For the students, a specific questionnaire for the 8 year old pupils and another for the 11 and 13 year olds were developed. As concern 5 year old pupils, after the implementation of a questionnaire developed during the pilot in Italy, it was decided to adopt only interviews.

For the teachers, two questionnaires were designed: one for the teachers of mathematics and the other for the teachers of science and technology.

All of the questionnaires are structured with multiple-choice questions and open questions. The number and the type of the items proposed in the questionnaire was calibrated in a way that guarantee the possibility to fill all of the questionnaire in at most one hour.

During the experimentation a total of 8198 student questionnaires (2666 of 8 , 2797 of 11 and 2735 of 13 year old) and 1425 teachers questionnaires were collected.

As concerning data analysis, it was decided to analyze the integral representation of questionnaires and to discuss significant elements,

combining the acquired data with the ones coming out from the analysis of the official documents and interviews.

In this presentation, we will present and discuss the data of the 11 year old student questionnaires in Italy and Poland.

Summary

Theoretical Framework

Research on cross national education surveys has a long history. Starting from the results of the International Association for the Evaluation of Educational Achievement (IEA) and following studies (Heyneman&Stephen, 2004), several recommendations have been issued for the planning of balanced, fruitful survey, mainly related to the procedures and the sampling methods of such work (Cochran,1997) and to the attention that must be devoted to the framework and to non-sampling errors in analysis (Lessler,1992).

In the view of performing a cross country analysis of the curricula, the definition of ‘curriculum’ itself has different meanings in different contexts of the educational research (Beauchamp, 1986;Walker,2003). There are a few substantive distinctions between those meanings (Clements,2007). To have a global vision of the curriculum, the analysis of the national documents is not enough, but the investigation of the acted end perceived document had to be done (Cochran, 1977).

To emphasize this aspects van den Akker (2003) proposed to represent curriculum as a spider-web in which the main subjects and aspects of the curriculum and the curricular research take place at different levels: rational, aims and objective, content, learning activities, teacher role, materials and resources, grouping, location, time, assessment. It is therefore necessary to develop questionnaire and interview aimed to investigate all the aspects of the curricular spider-web at the level of teachers and students (Kuiper et al., 2011).

Research Questions

The developed questionnaires were aimed to investigate the elements of the spider-web as perceived by teachers and students with respect to the curriculum. In particular for the pupils questionnaire, six main aspects of the curricular spider-web were addressed: motivation, learning activities, time, materials assessment and location. For each one of those aspects, pupil’s answers are analyzed to investigate their particular perception in each one of the involved countries and compare them cross-countries.

RQ1.Are students interested and motivated in the study of Math, Science and Technology (MST)?

RQ2.Which are the learning activities most used in schools?

RQ3.How much time pupils spend on MST?

RQ4.Which are the learning materials that pupils used in schools?

RQ5.How pupils are assessed?

RQ6.Where do the lessons take place?

Instruments and Methods

Four different types of questionnaires were developed to investigate teachers’ and the students’ perceptions the curriculum: two for students and two for teachers. All of the questionnaires are structured with multiple-choice questions and a few open questions. Questionnaires were structured in sections in accordance with the elements of the curricular spider web.

The questionnaire for the 8 year old students contain 96 multiple-choice questions and one open question, questionnaire for 11 and 13 years old combines 108 multiple-choice questions and 7 open questions and the two questionnaires for teachers have altogether 155 and 138 items for Math and Science/Technology, respectively.

The questionnaire for the 11 years old pupils was structured with 15 items on motivation, 27 on learning activities, 21 on materials and resources, 12 on location, 6 on time, 27 on assessment, and 6 open questions concerning learning activities and one open question regarding additional students’ comments. The number and the type of the items proposed were calibrated to enable to fulfill all of a questionnaire in at most one hour. Student questionnaires were filled in classroom, while teachers could also fill it at home. In the framework of the pilot study of the SECURE project a questionnaire for the 5 year old pupils was also implemented in Italy.

Sample

All over Europe, 1425 teachers and 8198 pupils questionnaires were collected (2666 of 8 years old, 2797 of 11 and 2735 of 13). In this presentation, the analysis of the Italian and Poland data of the 11 years old pupils is provided and discussed. The choice to address this particular age was driven by the consideration that 11 year olds represent a pivotal age around which pupils move from primary to secondary education and start to arise the pupils’ autonomous and critical thinking.

Results

Data analysis was done analyzing the integral representation of questionnaires (Fig. 1: example of graphical elaboration of the data

collected on Materials and resources in Poland), discussing significant elements and combining the acquired data with the information coming out from the analysis of the official documents and the data interviews.

In Poland, students like MST because of topics, activities and teachers. During MST lessons students mostly listen to the teacher's explanation and work on their own. Half of the students, in at least half of the lessons had to memorize how to answer questions both in MS, and 40% in T. Practical activities are more done in ST than in M, however, half of the students do practical activities rarely or never. For materials and resources (cf. fig.1), a vast majority does not use calculators and only less than 17% use computers in at least half of their lessons. Exercise books and textbooks are used in MS by 82% and 94%, respectively while in T by 14%. The use of everyday life objects in half of lessons of MST is, respectively, 36%, 52% and 28%. The majority of the students like what they learn in MST and enjoy learning. The main way of assessment in M are unexpected tests, in S -planned tests, projects and oral tests and in T-assignments. In MS most of the pupils do not go to different rooms, whilst for T the use of a different room is reported by less than one-third of students. The majority of all MST lessons is provided inside classroom. Students agreeing they spend a lot of time in school on MST (59%,58%,37%), while for homework the variation between subjects can be seen (49%,53%,27%).

In Italy, students like MST with no relevant differences between the reasons, while MS have more agreement (M70%-79%,S77%-84%) than Technology (57%-64%). With a threshold on "half the lessons", a mixed picture for the different activities is displayed: the prevalent one is "listen to teacher's explanation" (M89%,S81%,T77%), followed by "work on one's own" (M68%,S61%,T73%). "Memorize how to answer" is also relevant (M52%,S50%,T41%), while in T, it is passed by "do practical activities" (60%). "Work in small groups on a problem" has a very low percentage (M10%,S14%,T10%). Textbooks are used at least in half of the lessons (M89%,S93%,T66%). Exercise books are relevant in MS (M59%,S61%), while in T exercise books are only used by 18%, passed by various and daily-life materials (60%,27%). Calculators, computers and video have a lower or null impact (~10%). Most students like the things learned (M84%,S87%,T72%) and enjoy learning (M80%,S73%,T71%). For MS, the most significant methods are planned tests (57%, 57%) and oral tests (57%, 62%). The most part of students agree that MST are easy (M58%,S60%,T52%) and that they do well in them (M76%,S75%,T69%). The majority of the lessons are provided inside classroom (M99%,S83%,T84%). MS are considered as time demanding (75%, 65%), while for T, there is not a clear indication (50%).

Conclusions and Implications

By the comparison of the results of the data collected, a huge amount of analogies and only a few differences emerge from the results of the two countries that highlight similarities and relevant differences between them.

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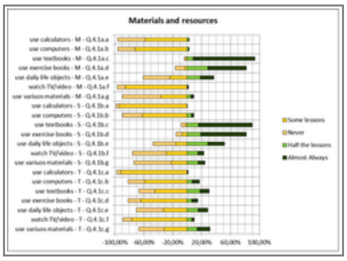
Appendices



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ABOUT

ESERA2013 is the 10th biannual Conference of the European Science Education Research Association (ESERA).

The theme of this ESERA conference is Science Education Research for Evidence-based Teaching and Coherent Learning, underlining aspects of great relevance in contemporary science education research: the need to reflect on different approaches to enhancing our knowledge of learning processes and the role of context, designed or circumstantial, formal or non-formal, in learning and instruction.