

Inquiring 5 years old pupils on MST curricula

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Abstract

The analysis of the official documents of a Country is not enough to have a “real” picture of the school curriculum in that Country. This analysis had to be flanked and integrated by the results of the investigation of the acted curriculum implemented by the teachers and the perception that the pupils have. With the aim to investigate 5 years old pupils’ perception of the curriculum of mathematics science and technology, two strategies for collecting data in kindergarten were implemented and experimented during the pilot phase of the SECURE European Project.

Keywords: Preschool education, kindergarten, curriculums of mathematics science and technology

Theoretical Framework

Substantial distinctions concerning the definition of “school curriculum” are present in literature [4,5]. Different meanings arise from different contexts in education research [3,4,7,8]. The analysis of the official document(s) is not enough just to have a clear vision of it. School curriculum and its modifications involve several different aspects related to institutions and subjects who are interrelated one with each other. A multilevel analysis is thus needed. Supra (international), Macro (national), Meso (school, institute), Micro (classroom, teacher), Nano (individual, pupil) levels had to be investigated to look to the whole audience for which they are addressed.

To emphasize this aspect van den Akker [1,2] propose to represent curriculum as a spider web (Figure 1) in which the main subjects and aspects of the curriculum and the curricular research take place.



Figure 1. Akker’s representation of the curricular spider web

The rational of the curriculum was placed in the centre and the components involved in the curriculum are placed around becoming the nine threads of the spider web which relevance varies on the five curriculum levels.

Contextualization of the research work

The work described in this paper was realized in the framework of the European Project Science Education CURriculum REsearch (SECURE) [6]. The SECURE project, financed by the European Union in the context of the Seventh Framework Programme, has the main goal of provide relevant and rigorous research data and translate them in recommendations useful to the debate on the curriculum of Mathematic, Science and Technology (MST) and their objectives among stakeholder and policy makers. A total of 11 partners in 10 Countries, of which 7 universities and 2 pedagogical institutes are involved in the project: Katholieke Hogeschool Kempen University College (BE), Dienst Katholiek Onderwijs vzw (BE), Universität Graz (A), University of Cyprus (CY), Technische Universität Dresden (D), Università degli Studi di Udine (I), Nationaal expertisecentrum SLO (NL), Uniwersytet Jagiellonski (PL), Univerza v Ljubljani (SI), University of Gävle (S), Nottingham Trent University (UK). The analysis and comparison between goals contents and teaching strategies proposed in the MST curricula of the involved Countries is the main research field addressed. In particular, the focus was on the identification of the shared grounds and the peculiarity existing among the MST curricula, the identification of good practices, the establishing of how the MST teachers put curricula into practice and how the current curricula affect learners' competences, motivation and perception of the relevance of the MST subjects for their life. The research work of the SECURE focus on 5, 8, 11 and 13 years old learners, their MST curricula and their teachers. These ages were chosen to investigate in depth the bridges and the gaps that there are between kindergarten, primary school and middle school in a comparable way between the involved Countries.

The implementation of the research in the SECURE project

The analysis of the elements pointed out by Akker in his spider web representation [1,2] was done on three levels: the level of the curricula in according with the official documents published by the National Ministry of Education, the level of the curricula implemented by teachers in the everyday practice and the level of the curricula perceived by pupils. The official curricula were analysed by means the use of an in-depth analysis of the official documents of each Country. The implemented and perceived curricula, instead, were analysed by means the use of questionnaires and interviews for teachers and pupils.

Two different types of questionnaires were developed for pupils: one for the 8 years old, and one for the 11 and 13 years old: the first one was constitute by 96 multiple-choice questions and one open question, while the second contained 108 multiple-choice questions and 7 open questions. As regard teachers, the subjects thought was the criteria for the differentiation in the questionnaire structures: 155 items for the teachers of mathematics and 138 for the teachers of science and technology. No questionnaire was proposed for the 5 years old pupils.

Questionnaires were filled by all of the MST teachers and the pupils in at least 15 classes per Country for the 8, 11 and 13 years old. Oral interviews were proposed to 6 classes per Country for the pupils of 8, 11 and 13 years old and all of the class of 5 years old and their MST teachers. Teachers' interviews were semi structured individual interviews, while

pupils' interviews were small group interviews done with four pupils (two girls and two boys, if the class composition allows it).

The Italian pilot study for the SECURE project

In the framework of the pilot study held in Italy a specific work was done for the development of a questionnaire and a specific strategy for its submission to the 5 years old pupils in kindergarten.

In cooperation with expert kindergarten teachers, a work of rephrasing and transduction was done to adapt the items of the questionnaire for the 8 years old to the needs of the 5 years old pupils. The main work was focused on the (re)contextualization of the questions proposed to the pupils. General and or abstract words as, "geometry", "calculation", "biology" etc. were changed with more contextualizing words as "work with shapes", "work with numbers", "work with plants and flowers" respectively.

A clear and well defined distinction was placed in the use of the verbs "to work" and "to play": we used "to work" when we referred to activities and actions proposed by the teacher, while "to play" is referred to activities and actions that are spontaneously prosed/done by pupils. This choice retrace the usual way adopted by the teachers in Italian kindergarten to make a clear distinction between the free time activities and the class activities. It means that in pupils' perception there is a big difference in meaning between the questions "How often do you work with...?" and "How often do you play with...?". That is important because the use of one verb or the other changes the set of the aspects investigated by the question: the first one investigates the learning activities, while the second explores the interest of the pupils with respect to the considered aspect.

In Table 1 are reported some example of rephrased questions.

Table 1. Example of rephrased questions for the 5 years old pupils

Original questions for 8 years old pupils	Rephrased version for 5 years old pupils
Do you like what you learn in Mathematics?	Do you like what you learn while you work with numbers (and shapes)?
We use various materials. For example: plants, stones, animals: Often /Sometimes/ Never	How many a time at school do you observe plants and animals?
We use exercise books Often /Sometimes/ Never	How many a time with numbers and shapes do you work with the booklets and worksheets given by your teacher?

The proposed strategies for data collection

Two classes of 5 years old pupils were involved into the pilot study. Twelve pupils composed each class: 6 boys and 6 girls in the first, and 5 boys and 7 girls in the second.

The rephrased questions of the 8 years old questionnaires, were proposed as a semi structured interview to both of the classes. Each question was thought as a multiple-choice question to which pupils had to replies choosing between three options.

Two sets of three possible answers were prepared: one for the questions which ask for an opinion and one for the question asking about "the amount of" or "how often". The first set

was constituted by three different smiles with different expressions: sad, neutral and happy. The second set was made by squares of different size that represents (from the smaller to the bigger): little–medium–large or never–sometimes–often.

To collect data, two specific procedures were developed and experimented separately in each class.

In the first class, we provide to each pupil a wooden skewer (a long toothpick) with some plasticine at one end of it, several preprinted smiles and squares of different size (Figure 2). Fixing one end of the skewer on the table using the plasticine, it remain in a vertical position; then the researcher read a question and, depending by the type of the question, ask to pupils to put the smile (or the square) that better represents their opinion as concern the question. Each pupil has its own skewer and to answer to the questions they had to select one smile or one square and put in on the skewer. At the end of the questionnaire, looking at the papers that the pupils put on the skewers, we can collect data on each answer gave by each pupil.



Figure 2. The wooden skewer adopted for the first strategy

In the second class, we use preprinted strips of paper on which pupils, coloring the mouth of the smiles or coloring one of the squares, can answer to each question. We use one strip of paper for each group of questions and each stripe as a number that allow us to identified which pupil compiled it. A schema of the preprinted strip is reported in Figure 3. As could be noticed, smiles have already three dotted mouths that represent the possible answers; this choice was adopted to avoid possible misinterpretation due to the possible ambiguity of the free drawing of the mouth.

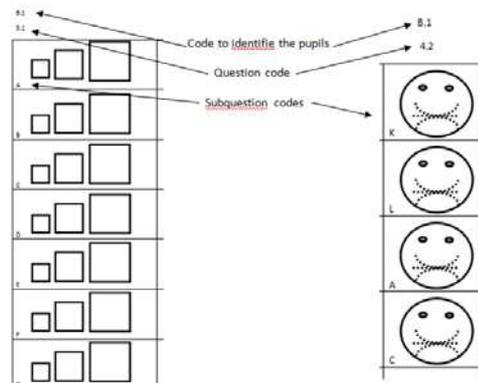


Figure 3. Example of preprint strips of paper adopted for the second strategy

Results and comments on the quality of the results for the two strategies

Table 2 and Table 3 report some example of data collected using the two strategies for what concern pupils’ opinions and the amount of the activity the do, respectively.

Table 2. Extract of the data collected as concern pupil’s opinions

	SKEWER			PAPER		
	☹	☺	☺	☹	☺	☺
Do you like working with numbers and shapes because you do them along with your friends?	1	3	8	2	1	9
Do you like working with numbers and shapes on booklets and worksheets given by the teacher?	4	3	5	0	2	10
Do you like to show others what you did?	0	1	11	0	0	12
Do you like working with experiments, plants and animals on the booklets and worksheets given by the teacher?	0	2	10	0	8	4
Do you like when you construct something and use it?	2	1	9	1	0	11

Table 3. Extract of the data collected as concern activities done by pupils

	SKEWER			PAPER		
	☐	☐	☐	☐	☐	☐
How many a time with numbers and shapes do you...	☐	☐	☐	☐	☐	☐
...work with the booklets and worksheets given by your teacher	0	3	9	0	0	12
...work with the other pupils	2	5	5	1	2	9
...measure	2	2	8	1	3	8
...play with the numbers	2	3	7	2	0	10
...present your results to the other pupils of the class	6	0	6	3	3	6
...make posters on what you have studied	2	4	6	5	3	4
...memorize how to do something	3	6	3	2	5	5

Even at a first look of the data, emerge how the replies of the pupils are not simply picked, but there is a distribution that gives a first insight for the presence of not strong mutual influences by the pupils. The analysis and the comparison one by one of the single answers to each questions provided by the pupils confirm this insight proving that there are not equal (or almost) equal questionnaire between each couple of pupils inside the class.

In addition, it emerges how, even if almost all of the pupils like all of the activities, there is clear gradation in the opinion that pupils have about the different activities. For instance, in the “skewer class”, they like more to show to the class what they did, then do the experiments (rows 5 and 6 of Table 2) and pupils in the “paper class” like more to work with number and shapes using worksheets than in the “skewer class” (row 2 of Table 2).

The same independence between pupils’ answers is true also as concern the questions related to the amount and the frequency of the activities.

In particular, looking at the different sections of the questionnaire, is it possible to notice how if there is a dependency between the pupils questions, this dependencies is only small present in the early questions, when pupils are still unfamiliar with the strategies proposed. However, after few questions (about ten) this dependency disappears also for pupils seated next one to the other.

Comments and conclusions

Both of the strategies adopted gave effective and independent results from which extract the pupils' opinions even if each strategy has its pro and contra.

In pupils opinion, the skewer strategy seems like a game and pupils enjoy it, but it requires a real strict and constant control about the researcher as regards the number of smiles/square each pupils put on the skewer. If one pupil doesn't put or put twice an answer, all the following answers will be out of phase. It is therefore necessary to use control paper, put by the researcher after each group of questions to reduce the propagation of such a type of error. In addition, it is necessary to be carefully in the transport and in the transcription of data because is important to maintain the order of the papers and the original data are not easy to store because, to transcript data, the researcher need to disassemble the original skewer.

In the paper strategy, instead, it is easy to look if all pupils are in phase with the answers and do not required particular attention in the transport of the data collected, but in pupils' opinion it is boring because it is like a work for them. This problem is strictly connected with the short time of attention of the pupils of 5 years: using the paper strategy, we need to shorten the questionnaire and/or to propose it in different sessions during several days.

For both strategies, there are also a series of a general remarks that arise from the work done. To adapt effectively the questionnaire proposed to the 5 years old pupils, we had to refer to specific experienced situations that are part of the specific group of involved pupils. Even if there are no mutual influences between pupils there are several self-influence because in pupils answers there is almost no distinction between emotive and factual experience; i.e. asking them "How many...?" their reply is strongly influenced by the opinion they have about what you ask for (if they like or do not like it). Indeed, replying to the question proposed, the 5 years old pupils referred usually to their all life experience, without referring to a limited interval of time.

Those remarks represents a limitation to the nature of the data collected, but they do not confuted the validity of the data collected using the two proposed strategies that proved to be effective in the investigation of the opinions of each pupils providing an environment in which the mutual influences between pupil are negligible.

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