



ISSN 1648-3898

EARLY SCIENCE TEACHING IN THE NEW PRIMARY SCHOOL IN SLOVENIA

Abstract. *Focusing the problem of rapidly disappearing interest for natural science and technical studies the Slovene school system began to reform natural science and technical teaching from the beginning - from the primary level. The article presents the results of the empirical study, which monitored the changes of quality in early science teaching on primary level after changes of school system at the end of the millennium.*

Key words: *empirical study, science education, primary school.*

Vlasta Hus, Boris Aberšek
University of Maribor, Slovenia

Vlasta Hus, Boris Aberšek

© Vlasta Hus
© Boris Aberšek

Introduction

With establishment of a new independent state, Slovenia changed its school system from the primary to the university level. Careful thoughts have been spent and still are in the area of natural science and technical education/technical science teaching. Focusing the problem of rapidly disappearing interest for natural science and technical studies the Slovene school system began to reform natural science and technical teaching from the beginning - from the primary level. It is very possible, that the reason for this disappearing interest for science and technology studies is not connected only with the way how we are teaching, but also (maybe primary) because our life style and our worth in general has been changed. In this paper this socio-economical point of view will not be discussed. However, we will give our attention only to the pedagogical, didactical point of view.

On the primary level (in the first trilenium of the compulsory **nine year "basic" school**) the natural science and technical education are implied in the school subject, so called **"Environmental education"** (Krnel, 1996). This subject has replaced the existing subject called "Early natural and social studies". The curriculum of the Environmental education is based on recent theoretical, developmental, psychological and methodological findings (Pohl, 1997, Pohl, 2000a, Pohl, 2000b). It results from the learning target and process strategy of the curriculum planning and it is based on the constructivist and humanistic theory of learning and teaching, with greater emphasis on cross-curricular links between subjects, and on increased teacher autonomy (Bloom,



1984, Fullan, 2001). The only compulsory parts of the curriculum are the teaching aims while the pupils' activities, didactic recommendations and suggested cross-curricular links are an optional part and can therefore be replaced with more convenient criteria. In the didactic references of the national curriculum for the Environmental Studies a particular emphasis is placed on the consideration of pupil's experiences and ideas, on children's concrete activities, which should be controlled in the first grade and which should lead to concrete products, on the variety of teaching forms and methods, on a significant consideration of individual differences in pupils' abilities, and on indirect observations of the environment (White book, 1995, National curricula board, 1998).

Such an orientation of the teaching will eliminate the basic deficiencies, which appeared in the subject of Early natural and social studies like: the prevailing frontal teaching, the prevailing verbal-textual and illustrative-demonstration teaching methods, too much of dealing with ideas, which led to factography and to a low level of knowledge (Kordigel, 1991/1992). The emphasis was placed on the realization of mainly material tasks of school lessons, whereby the functional and educational tasks were neglected. These are the evaluation findings of the experimental introduction and observation of the curriculum from 1957 (Šegula, 1964) and from 1983 (Adamič, 1990). The results of the international comparative studies IAEP, in which also our third-year pupils were included (natural science), showed more increased efficiency in tasks which demanded only a reproduction of what was learned than in tasks, in which it was necessary to integrate knowledge and use it in solving certain problems. In accomplishing the latter tasks they occupied the last place (Piciga, 1993, Kordigel, 2002).

In this paper we present the study, in which we have tried to find out how the planned changes in the curriculum of the Environmental Studies were realized in practice by means of empirical research (Hus, 2001, Hus, 2005).

Definition of the problem

In our research we have tried to find out how the lessons of Environmental Studies in the first year of the "new" nine-year education programme differ in quantity and quality from the lessons of the Natural and Social Sciences in the first year of the "old" eight-year education programme. According to the "new" education programme the *children start their education at the age of 6 and continue until the age of 15* while according to the "old" education programme the children started their education at the age of 7 and have continued until the age of 15 (Labinowicz, 1989). We focused on planning and presenting both subjects within three common thematic clusters. We compared teaching aims and analysed their dimensions (Pohl, 2000a, Pohl, 2000b). We analysed the appropriateness or suitability of interaction, teaching methods, teaching aids, resources, lesson structures or stages of lessons and the participation of pupils in relation to the achievement of the teaching aims in both subjects. We were also interested in the pupils' attitude towards the respective subject. We investigated the teacher's opinion about the reformed school subject (Zoldosova, 2006).

Methodology of Research

Method

The basic research method was causal non-experimental method of pedagogic research.

Sample and data gathering

On the level of the indirect observations of both subjects the sample contained:

- 18 detailed curriculum or annual teaching plans, 9 for each subject or in other words one from each unit of the Board of Education),
- 36 teaching plans, including the teachers, who were involved in the indirect lesson observations of both subjects.



Four primary schools belonging to the Maribor region of the Board of Education were selected for the direct systematic classroom observations of the Environmental Studies and Natural and Social Sciences. Two schools started introducing the nine-year primary school programme in the academic year 1999/2000 while the other two schools carried out the programme of the eight-year primary school programme. A class of the first year pupils was selected in each school. The research included eight primary school teachers and two nursery nurses.

Classroom observations were performed in February, April and May in the academic year 1999/2000 according to three common thematic clusters: Celebrations, Garden and Meadow. Each cluster lasted for three 45-minute lessons. The time of audio and video recorded materials added up to 18 hours for each of the subjects.

The final year students and the graduate students of the Department for Junior Primary School Programme at the Faculty of Education helped us with the direct classroom observations. They had been trained for this task for a longer period of time. Several students were involved in some aspects of the lessons in order to achieve greater data objectivity.

Technical equipment was yet another means for classroom observations. A cassette player was used during all classroom observations. A video camera was used to record only one lesson at each school.

Regarding the pupils' feelings during the lessons the sample contained all four classes of selected schools. 286 pupils were involved in the ES and 269 in the NNS.

All the teachers and nursery nurses who were teaching the first year pupils in the nine year primary school programme in the academic year 1999/2000 (128) were included in the sample of examining the teachers' and nursery nurses' attitude towards the Environmental Studies. However, the data processing involved only 39.8% of them.

Instruments

This research used the following instruments:

- *A curriculum evaluation criteria* (the National Curriculum, detailed curriculum, thematic clusters and teaching plans);
- *An observation protocol* (to record some dimensions of the learning process, to record levels of questions and strategies for asking questions, to observe the distribution of the teacher's questions among the pupils-Hopkins, to write down pupils' activities during a lesson, to observe the stages of the lesson);
- *A checklist* (to assess the typical characteristics of the learning process);
- *Two questionnaires* (one for the pupils and one for the teachers and nursery nurses).

Data processing

The data was processed on the level of descriptive and inferential statistics. The procedure of frequency distribution (f , $f\%$) was used along with the chi-square test (χ^2) and Kullback test ($2i$) (Kullback, 1968).

Results of Research

The most important findings are the focusing point of the results and interpretation.

The evaluation and comparison of teaching aims in the national curriculum

The main finding was that there are differences in both curriculums which depend mainly on the various starting points of the values and different strategic plans of both curricula. The teaching aims of the Environmental Studies are more students centred. They are written on all three levels (general, periodic and operational). Their cognitive component is emphasised. However, the aims of the natural



science field are more central. The teaching aims of the Natural and Social Sciences are oriented more toward the society. They are written only on the general level. Their educational component is emphasised and the focal points are the aims of the social science field.

The evaluation and comparison of teaching aims in the detailed curriculum of teachers' plans

The differences between the two subjects can be seen in the planning of teaching aims according to their written records, in the definition of their temporal realization, in the number of recorded aims and considering the correlations with other subjects, as well as the analysed detailed curricula and teaching plans. There are no differences between the subjects in the written records of teaching aims in their dominant extent and dominant taxonomic levels of cognitive teaching aims (knowledge).

It can therefore be said that although there is a different approach in the curriculum planning of the Environmental Studies, the teachers and nursery nurses are confronted with the following specific problems when designing teaching aims: their operation, determining their basic extent and their variety.

In the table below is the data gathered by means of systematic observations of lessons of both subjects.

Do the lessons of the Environmental Studies differ from the lessons of the Natural and Social Sciences regarding the affirmation of pupils' grouping?

Table 1. The number and the structural percentage of lessons with the dominant grouping of pupils.

Lessons Grouping pupils	ES		NSS	
	F	f%	f	f%
Whole-class grouping	5	27.8	13	72.2
Group work	12	66.7	1	5.6
Pair work	0	0.0	0	0.0
Individual work	1	5.6	4	22.2
Total	18	100.0	18	100.0

$$[2 i = 14.58 > \chi^2 (p = 0.01, g = 3) = 11.34]$$

From the statistic point of view there is a significant difference between the Environmental Studies and the Natural and Social Sciences regarding the dominant grouping of pupils. The group work was the most dominant grouping during the Environmental Studies and whole-class grouping during the Natural and Social Sciences.

Do the lessons of the Environmental Studies in the first year differ from the lessons of Natural and Social Sciences based on the general use of teaching methods?

Table 2. The number and the structural percentage of lessons of the dominant teaching methods.

Teaching methods	ES		NSS	
	f	f %	f	f %
Verbally textual	6	33,3	16	88,9
Illustratively-demonstrational	2	11,1	0	0,0
Laboratory-experimental	8	44,4	2	11,1
Experiential learning	2	11,1	0	0,0
Total	18	100,0	18	100,0

$$[2 i = 13.15 > \chi^2 (p = 0.01, g = 3) = 11.34]$$



From the statistic point of view there is also a significant difference between the Environmental Studies and the Natural and Social Sciences regarding the dominant teaching method.

The laboratory-experimental teaching method was the most dominant teaching method while teaching the Environmental Studies and verbally-textual teaching method while teaching the Natural and Social Sciences.

Is there a difference between the types of pupils' activities during the Environmental Studies and the Natural and Social Sciences in achieving target teaching aims?

Table 3. Types of activities pupils participate in during the Environmental Studies and the Natural and Social Sciences.

Pupils' activities	ES		NNS	
	f	f %	f	f %
Physical	486	26.9	586	22.3
Sensory	367	20.3	323	12.7
Mental	415	23.0	741	29.1
Expressive	538	29.8	912	35.8
Total	1806	100.0	2544	100.0

$$[2 i = 76.01 > \chi^2 (p = 0.001, g = 3) = 16.27]$$

There is a significant statistic difference between dominant types of pupils' activities during the lessons. The pupils attending the Environmental Studies were more physically active and used their senses more while the pupils who attended the Natural and Social Sciences were more expressive and mentally active.

The most dominant physical activities during the Environmental Studies were object manipulation and walking and during the Natural and Social Sciences walking and standing up.

The most prevailing mental activity was recognition during the Environmental Studies and counting during the Natural and Social Sciences.

Throughout the Environmental Studies pupils expressed themselves mostly by talking to their partners and throughout the Natural and Social Sciences they answered the teacher's questions.

The most common sensory activity throughout the Environmental Studies was seeing (observing) and the following activity: thinking, which means more problem solving oriented; the Natural and Social Sciences it was hearing (listening), and the following activity: learning what was heard, which means factography oriented.

Are there any differences in the didactic structure between the two subjects?

There is no statistically significant difference between the two subjects ($\chi^2 = 3,00$, $P = 0,05$) regarding the number of teaching stages during the lessons observations. Additionally, only three out of five possible teaching stages occurred.



Table 4. Approximate length of each stage of both subjects and the number of lessons where an individual stage occurred.

Teaching stages	ES		NNS	
	<i>min</i>	<i>No. hours</i>	<i>min</i>	<i>No. hours</i>
Motivation	7.5	16	11.0	18
New subject matter	24.4	9	35.5	16
Practice	33.2	10	0.0	0
Revision	16.2	6	20.5	8

It is evident from the table above that on average practice lasted the longest during the lessons of the Environmental Studies. In the lessons of the Natural and Social Sciences the new subject matter prevailed but there was no practice. In addition, neither of the subjects contained testing and assessment as an individual stage.

Are there any differences between the two subjects regarding prevailing teaching aids and sources of knowledge?

During the Environmental Studies the most prominent teaching materials (didactic aids) were the ones for practical usage of pupils. Pupils worked with various materials such as clay, paper, steel wire, and used various tools, for example, scissors, trowels, whole punches, etc.

During the Natural and Social Sciences the teaching materials (didactic aids) demanded more mental action from the pupils, such as work with handouts, different texts, and more action from the teacher, namely work with overhead projector (OHP), OHP transparencies, writing on the board, etc.

There is no statistically significant difference ($\chi^2 = 1.38$, $p = 0.05$) between the Environmental Studies and the Natural and Social Sciences regarding the prevailing sources of information and knowledge. In both subjects the straightforward reality is the most prevailing source of knowledge.

On the basis of the classroom observations and the checklist data about the characteristic features of the teaching process it can be seen that the lessons of the Environmental Studies were designed according to modern pedagogical doctrine (Marentič Požarnik, 2000, Strmčnik, 1998, Tomič, 1999), that means that students were put in more active role, than at the lessons of the Natural and Social Sciences. Teaching aims planned mainly in a cognitive way in the Environmental Studies were realized with those pupil groupings and teaching methods which ensured active participation of pupils in the teaching process to a greater extent. However, problems do already exist in the initial stages of the lesson structure and the accomplishment of individual phases when the teacher or nursery nurse communicate with the pupil.

How did the pupils feel during the lessons?

There exists a statistically significant difference between the subjects according to the pupils' feelings ($\chi^2 = 44.12$, $p=0.001$). In general, pupils who attended the Environmental Studies felt themselves more successful, more comfortable, simply better, than the ones who attended the Natural and Social Sciences. This was influenced by internal and external organisation of the lessons. The pupils' feelings were not influenced much by the external organisation of lessons but by the teacher's or nursery nurse's didactic-methodological basis of the teaching process, or in other words, the choice of pupil groupings, teaching methods, teaching aids, sources of knowledge, accounting for teaching stages when achieving specific teaching aims. They were selected in the Environmental Studies in order to enable active role of pupils in the teaching process. Positive feelings, such as pleasure towards work, excitement and interest, were detected during the lessons which involved active pupils' participation. They enjoyed the work while making a butterfly, making a garden in the classroom,



picking up meadow plants, chasing meadow animals, making a herbarium, etc. Most activities pupils were involved in resulted in a tangible product. *Pupils were happy and proud of their own success.* Each pupil had an opportunity to assert themselves according to their abilities. These activities mainly involved group work that is why the pupils were working as a team, helping each other, exchanging opinions, persuading each other, solving conflicts, etc. Their learning was typical of natural and experiential learning which is very close to the pupils of this age.

What do the teachers and nursery nurses think of the Environmental Studies a year after its implementation?

The opinions of the teachers and nursery nurses do not differ significantly when it comes to the questions in the questionnaire. They both classify the subject of the Environmental Studies among the relatively popular subjects as they believe this is due to a higher degree of the psychological and physical effort of the teacher and the lack of suitable didactic materials.

Both teachers and nursery nurses realize there are problems in devising the lessons of this subject particularly when it comes to detailed annual planning of the curriculum. However, they do not mention any major problems with the subject's performance and its evaluation (MacBeath, 2001). A year of team work experience between a teacher and a nursery nurse has been assessed as very successful. Most of them think that team work contributed to making the lessons of the Environmental Studies more qualitative. They have exposed the greater opportunities for active pupil groupings and teaching methods, as well as better chances for the individualisation of the lessons. According to the questionnaires the most appropriate additional education was organised by the publishing houses Državna založba Slovenije and Modrijan when the coursebooks series on the subject were published. The less appropriate education turned out to be the one offered by both Pedagogical Faculties and the Board of Education. The pedagogic workshops were the best rated form of education.

Conclusion

We have discovered that in most aspects the Environmental Studies teaching is of better quality (because it is more student oriented, the quality of knowledge is better etc.) if compared to the teaching of the Natural and Social Sciences regarding the observed didactic components. This can be seen as a result of different conceptual and didactic structures of the Environmental Studies and additional continuous work and team work of the teaching staff. Furthermore, it is due to a better material basis/financial status of the Environmental Studies lessons, a lower number of pupils in the class and also to the phenomenon of innovation. The fact that the pupils feel better and the teachers, as well as nursery nurses have a more positive attitude towards the subject, is very stimulating. The results of our research should, above all, contribute to the quality of planning, implementation and evaluation of the teaching of the Environmental Studies in the first year, as well as in the following two years of the nine-year primary school programme. We also consider them useful in the education of the future teachers and nursery nurses of the Environmental Studies in the primary school education.

References

- Adamič, M. (1990). *Spoznavanje narave in družbe (1. do 3. razred)*. V: Logar, T.(ur.), *Evalvacija programa življenja in dela osnovne šole*. Ljubljana: Zavod RS za šolstvo (In Slovene)
- White book of education in the Republika of Slovenia*. (1995). Ljubljana: Ministry of education and sport.
- Bloom, B. S. (1984). *Taxonomy of educational objectives*, Boston, MA, Allyn and Bacon.
- Fullan, M. (2001). *The Meaning of Educational Change*. New York: Teachers College Press.
- Hus, V. (2001). *Pouk spoznavanja okolja v prvem razredu devetletne osnovne šole* (doctoral thesis). Ljubljana: Filozofska fakulteta-oddelek za pedagogiko, (in Slovene)
- Hus, V., Ivanuš Grmek, M., Čagran, B. (2005). *Izvajanje vzgojno-izobraževalnega procesa pri predmetu spoznavanje okolja v prvem triletju devetletne osnovne šole*, Maribor, Evaluations study, Ministry of Education and sport, (in Slovene).
- Kordigel, M., Saksida, I. (1991/1992). *Branje ali branje*. Ljubljana, *Jezik in slovstvo*, 37, 4-4, str 75-82, (in Slovene)



Slovene)

- Kordigel, M., I. Saksida (2002). *Jaz pa berem*. Ljubljana, Rokus, (in Slovene)
- Krnel, D. (1996). *Nastajanje nove podobe predmeta Spoznavanje okolja v prvem triletju osnovne šole*. Ljubljana: PRKK za Spoznavanje okolja, (in Slovene)
- Kullback, S. (1968). *Information Theory and Statistics*, New York, Dover Publication
- Labinowicz, E. (1985). *Learning From Children*, Addison Wesley Publishing Company
- MacBeath J., P. Mortimore (2001). *Improving School Effectivnees*. Open University Press. Buckingham.
- Marentič Požarnik, B. (2000). *Psihologija učenja in pouka*. Ljubljana: DZS, (in Slovene)
- National curricula board (1998). *Curriculum for Environmental Education*, Ljubljana, Ministry of Education and sport.
- Piciga, D., Japelj, B. (1993). Rezultati mednarodnih primerjalnih študij naravoslovja za osnovno šolo: Slovenski učenci v IAEP študiji. *Educa*, str. 136-174, (in Slovene)
- Pohl, M. (2000). *Teaching Complex Thinking: Critical, Creative, Caring*. Cheltenham, Hawker Brownlow Education.
- Pohl, M. (1997). *Teaching Thinking Skills in the Primary Years: A Whole School Approach*. Cheltenham, Hawker Brownlow Education.
- Pohl, M. (2000). *Learning to Think, Thinking to Learn: Models and Strategies to Develop a Classroom Culture of Thinking*. Cheltenham, Hawker Brownlow Education.
- Strmčnik, F. (1998). Od klasičnega do kurikularnega učnega načrta. *Sodobna pedagogika*, let. 49, št. 1, str. 1-16, (in Slovene)
- Šegula, I. (1964). *Učni načrt osnovne šole v teoriji in praksi (rezultati petletnega preizkusa)*. Ljubljana: Zavod za napredek šolstva, (in Slovene)
- Tomic, A. (1999). *Izbrana poglavja iz didaktike*. Ljubljana: Center FF za pedagoško izobraževanje, (in Slovene)
- Zoldosova, K., Prokop, P. (2006). Education in the field influences childrens ideas and interest toward science. *Journal of Science Education and Technology*, let. 15, št. 3, str. 304

Резюме

ЕСТЕСТВЕННОНАУЧНОЕ ОБРАЗОВАНИЕ В НАЧАЛЬНЫХ ШКОЛАХ СЛОВЕНИИ

Власта Гус, Борис Абершек

Статья представляет результаты эмпирического исследования, цель которого было проанализировать изменение качества естественнонаучного образования в начальных школах Словении после реформы системы образования. После создания нового независимого государства, Словения изменила ее школьную систему от начального до университетского уровня. В стране тоже наблюдается тенденция быстрого снижения интереса к естествознанию и технике. Исходя из данной ситуации словенская школьная система начала преобразовывать естественнонаучное и техническое образование с начального уровня (начальной школы). В нашем исследовании мы пробовали узнать, как уроки «Исследование окружающей среды» на первом году «новой» девятилетней программы образования отличаются по количеству и качеству от уроков Естественных и Общественных наук на первом году «старой» восьмилетней программы образования.

Ключевые слова: школьная система, естественнонаучное образование, начальная школа.

Received 20 February 2007; accepted 13 March 2007

<p>Vlasta Hus</p>	<p>Assistant Professor at the Faculty of Education, University of Maribor, Slovenia. Koroška cesta 160, 2000 Maribor, Slovenia. E-mail: vlasta.hus@uni-mb.si</p>
<p>Boris Aberšek</p>	<p>Professor at the Faculty for Science and Mathematics, University of Maribor, the Head of department of Technical Education and Vice-dean for research work and post graduate studies. Koroška cesta 160, 2000 Maribor, Slovenia. E-mail: boris.abersek@uni-mb.si</p>

