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QUANTITATIVE AND QUALITATIVE COMPARISON OF SETS WITH PRE-SCHOOL CHILDREN WHO ALSO LEARN ENGLISH LANGUAGE

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ABSTRACT

This paper deals with two general ways of comparing sets adapted to preschool children. Special attention is paid to the relations "greater than", "less than" and "equals to" and to the usage of the appropriate terms in English.

The presentation will be multimedial and interactive, computers and multimedia being used in many classroom activities as teaching mathematics and English as a second language. Computers in teaching expose pupils to many different experiences and are a great help in promoting interactive learning.

As one of the consequences of the globalization of the society there is an increasingly great need for learning one or more foreign languages, starting as early as possible. Pre-school institutions have proven themselves to be excellent places for the realization of this need as they offer great possibilities for organized and not intrusive teaching of foreign languages, especially in correlation with other educational areas such as the culture of expression, mathematics, musical education, ecology etc.

Trying to record the situation in these institutions in the city of Shtip in the Republic of Macedonia, from the aspect of teaching foreign languages in correlation with other educational areas, we have found the following situation:

- In all kindergartens (eight), without exception, English is introduced as early as the age of four on an elementary level.
- The teaching is performed by insufficiently trained teachers because the existing universities in Macedonia at the moment do not offer an appropriate training for this profile of teachers.
- The teaching personnel works by a non-standard curriculum, i. e. The Bureau for the development of education in the Republic of Macedonia has not yet offered a unified curriculum for English language in pre-school institutions.
- Educational activities in teaching English are not well correlated with the other educational areas in pre-schools, which means that each teacher decides what should and what should not be taught to the children depending on their age.
- In spite of these shortcomings children eagerly expect English lessons and readily perform the expected activities and there are positive results in children's motivation for verbal expression.

Let us just mention the fact that the pre-school institutions in the Republic of Macedonia have not been turned into private property yet.

WHY WE HAVE CHOSEN QUANTITATIVE AND QUALITATIVE COMPARISON OF SETS

The need for content of sets and operations with sets in the annual programme offered by the Bureau for the development of education in the Republic of Macedonia in pre-schools comes from the great opportunities for the realization of educational influence upon children. Thus, beside acquiring some elementary mathematical knowledge the children are introduced into research work, they practice simple generalization, classification etc. In the course of organized activities in pre-schools children notice "groups" (entireties) of objects of the same kind, i. e. objects that have some common characteristic. Forming sets according to the given characteristic and a subset of a given set the children are introduced into classification. Later on they classify according to two or more characteristics and this process makes them think, analyse and compare.

The notion of a set is the foundation for the forming of the abstract concept of a natural number. In fact, the connection between the "objective reality" and the "world of numbers" is the "world of sets". According to Piaget the number as a notion results from the synthesis of the

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logical operations of seriation and classification. So, by means of working with concrete objects (sets) the children are led from the act of perception to the act of intelligence, i. e. logical mathematical thinking. By manipulating concrete objects which are the elements of a given set the children discover more characteristics of the objects, some of which they reject as non-essential and they point their attention to the essential ones upon which they generalize. During this work with sets the children gain respective knowledge in an empirical way. What the children perceived they then enunciate with words and in this way possibilities are created for verbal expression and the formalism of their knowledge is reduced.

The practice shows that the notion of a natural number and the arithmetical operations with numbers on an elementary level are formally learned in the preparatory year and the first grades of elementary school. It is our belief that this is the basic reason for the students' knowledge with unsuitable content. A part of the cause of formal knowledge of arithmetic lies in the school practice, but an even greater part comes from the theory. Namely, the didactic of mathematics has not still shown an effective enough way for studying numbers with children in pre-school and early grades of elementary school. As there are not enough modern methods and teaching aids the above mentioned institutions achieve the didactic aims in arithmetic through numerous, monotonous and often similar drills and repetition. Despite this, the number does not become less abstract and it does not turn into an operational concept enough.

These are the reasons why we want to establish a correlation of the processing of contents of quantitative and qualitative comparison of sets where the essence of the notion natural number is discovered, and we want to arouse the children's curiosity and their explorative spirit through an interactive multi-media, computer made presentation so that the child could parallelly learn the terms in English and the mathematical concepts through pictures, tones and speech. With this we want to contribute to the modernization of teaching in pre-school institutions and to more effective teaching of numbers in foreign languages.

The essence of the quantitative comparison of two or more sets is the comparison by the number of elements, but not by the nature of the elements in the sets. In this way, through the establishing of mutual one-directional (bijective) mapping, the notion of a natural number is introduced, as a quantitative characteristic of a class of equivalent sets.

The good side of the quantitative comparison of sets is that it could be performed with children at the age of four graphically, visually and orally without using numbers, i. e. it is not necessary for the child to know how to count.

During the solving of problems of quantitative comparison of two sets at this level we can encounter the following cases:

1. The first set has a smaller number of elements than the second set;
2. The first set has the same number of elements as the second set;
3. The first set has a greater number of elements than the second set.

At this point we can find the connection with the teaching of English through studying the essence of the terms "more than", "the same as" and "less than" at the same time studying the same mathematical relations. Until now we have not found cases of teaching these terms in English. The closest terms taught are *tall-short*, *long-short*, *big-small*. This in fact is comparison by length, not by number of elements of a set, which is the subject of our research.

At the age of 5-6 the above mentioned problem is solved through introducing the concept of a number as a characteristic of quantity of each set.

The last number that we get when counting each element of a given set is called the number of elements of a set. This number does not depend on the sequence of counting of elements, i. e. if we count the elements in different order we will still get to the same number. At this moment it could be asked "How many" about the whole set and not only its given element. This procedure starts with naming of numbers one, two, three . . . which express the number of elements of given sets as their quantitative characteristic. Thus, the natural number becomes a mathematical model of a concrete set and a crossing is created from a set to a number (from the concrete to the abstract).

It is good to mention that in this manner the following aim is achieved: the children not only name numbers with their terms in English but they also make sense of their essence, realizing the concrete aims of the educational work in mathematics.

The qualitative comparison of sets is performed according to the nature of their elements. This can be done in early childhood, but in correlation with English we would recommend the age of 4-5. At this age the terms "equal" and "different" are introduced as representatives of the relation "equal sets" where it is not enough for the sets to have only the same number of elements but to have the same elements. This stage is suitable for naming of elementary mathematical forms as triangles, squares, rectangles, circles etc.

The modern way of life and the communications constantly increase the need for a complete and qualitative mathematical education and mathematical culture in general. At the same time, there is also a compelling need for learning English as early as possible. Having this fact in mind we have made a pilot research in which we acquired information about the level of learning of the contents of qualitative and quantitative comparison of sets and the respective terminology in English.

The research was performed in the month of May 2004 in kindergartens "Vera Ciriviri Trena" and "Astibo" in Shtip, Macedonia in senior and half-time groups.

THE AIM OF THE RESEARCH

The basic aim of the research is collecting data for the possibilities of a more effective and correlated study of the English terminology with the children of the target groups in the thematic area 'sets, comparison of sets, counting' which will serve as:

- indicators of the level of learning of mathematical educational area and the respective terminology in English;
- the empirical base for the discussion about the quality of the programme offered by the Bureau for the development of education and the "Step by step" programme, as well as about the designing of a unified curriculum for the English language in pre-schools in Macedonia;
- indicators for more thorough and more elaborate research in future.

THE HYPOTHETICAL FRAME OF THE RESEARCH

The accepted conceptual frame is that the children are able to learn about sets, work with them and compare them as it is outlined in the curriculum. It is also accepted that the children learn more easily the terms in English when they are supported by a visual, oral and interactive multi-media presentation.

THE REALIZATION OF THE RESEARCH

The conceptual frame and the aim for which the data will be used determined the manner of the research and its instruments.

The subject of the research was the achievement of pupils in mathematics (set content) and their learning of the respective terms in English.

An interactive multi-media computer presentation has been made that presents the assigned tasks visually, with pictures, tone and sound, and at the same time a brand new means of didactic (a computer) is presented to the children.

TESTS OF KNOWLEDGE

Before starting with the preparation of tests we have viewed the curriculums for mathematics. The starting point was the determination to measure the cumulative achievements of children in mathematics (set content). While deciding about the areas and aims we had in mind our determination for test tasks, i. e. the use only of tests of the type computer-touch. A great number of test tasks from the following educational areas were prepared:

- determining of a characteristic according to which the given sets are formed and compared;
- noticing and making a graphical presentation of a subset of the given set;
- noticing and comparing the number of elements in two or more sets with the application of English terms;
- noticing and comparing sets according to the type of elements with the application of English terms;
- counting, counting off, counting aside, and comparison of numbers in English

Each aim of the exam programme was represented with one test. Sixteen test questions were chosen. Special effort was made to devise tasks with various levels of difficulty in order to cover the whole range of children's mathematical knowledge (sets, comparison of sets, counting). The children were not informed about the test.

THE SPECIMEN AND THE COURSE OF THE RESEARCH

The specimen consists of the children in kindergartens "Vera Ciriviri Trena" and "Astibo". The observation of the children is performed during practical activities of the fourth-year student of Pre-school education in the premises of the mentioned institutions. The teachers were interviewed in the second week of April, according to the previously established protocol for the interview.

THE DATA PROCESSING AND THE ANALYSIS OF THE RESULTS

According to the indicators of how much of the test was solved, the following results about the achievements of children were got;

- 98% of children solved Test 1 correctly and without difficulties. It can be said that these pupils are able to represent a set graphically and determine a subset of the set according to a given characteristic. In this context, they successfully name sets and appropriate elements in English;
- 75% of children are successful in quantitative comparison of sets. There were some problems with the usage of the terms "more than", "less then" and "equal" which are the representatives of the appropriate mathematical relations;
- 55% of children, in addition to the above mentioned, try to solve a problem in which the possibility for a qualitative comparison of two sets is tested, but they had difficulties in naming the terms in English. In this task certain freedom was left in the manner of thinking and there were more correct or partly correct answers. This will further serve us as a mark for discovering talented children in the mathematical and logical areas.
- 45% of children successfully solved all four tasks with sets and understood the essence of the concept of numbers and they had no problems in naming them in English.

From the above mentioned we can state that most of the children were relatively successful in solving the given tasks, which in turn justifies the hypothesis, i. e. that the children can easily learn the concepts of sets, elements and subsets and to compare sets using the respective terms in English. We are especially glad because the children were pleasantly surprised by the new way of performing the teaching activity and they almost without any difficulty and spontaneously communicated in English. This is also an indicator that modern technology should be used more often in the educational process.

This pilot research will serve us as a foundation for further research in order to qualitatively solve the dilemma: can mathematical contents be successfully taught in pre-schools in a foreign language, specially English?

CONCLUSION AND RECOMMENDATIONS

The theoretical research, the practical findings and the increasing need for a qualitative mathematical culture in modern life styles give us the right to say that in pre-schools the contents of sets on an elementary level should be introduced. It would be even better to teach these contents parallelly with a foreign language, in accordance with the way of living.

The curriculums for foreign languages, especially English, in pre-schools in Macedonia should be prepared as soon as possible including contents of sets and their comparison in the mathematical educational activities and in correlation with other areas of study, paying particular attention to senior age groups.

At the Pedagogical faculty "Goce Delchev" Shtip until now the subject Teaching methods for foreign languages has not been taught. But, with the transformation of curriculums according to the ECTS, this subject will be one of those that the students can choose. In this way they will be able to teach a foreign language in pre-school institutions, which in turn will contribute to the modernization and the attraction of study programmes at our Faculty.

The students of Pre-school education at the Pedagogical faculty in Shtip will continue their training in future in the same direction so that they would be able to appropriately answer to the needs of modern teaching and prepare our future generations for qualitative and thorough discovering of the secrets of mathematics and foreign languages.

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