RELATIONS BETWEEN CONTENTS FROM TEACHING SUBJECTS MATHEMATICS AND PHYSICAL AND HEALTH EDUCATION IN PRIMARY EDUCATION

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Abstract

Considering modern educational tendency in the system of primary education that refers to the possibilities to establish integration - correlation relationships between educational contents from different teaching subjects in primary education, in this paper we made a theoretical elaboration of contents from two teaching subjects: math and physical and health education as an approach that allows efficient acquisition of knowledge and their efficient application in everyday life. The analyses of math and PHE curricula from first to the fifth grade in nine year compulosry education is used as a foundation for future determination of aims, tasks and contents from these two teaching subjects in order to establish integration - correlation relationships. Concrete examples of correlationn between previously mentioned subjects are presented in order to help children to achieve holistic, long – lasting and practically applicable knowledge's.

Key words: teaching contents, correlation, integration, math, physical and health education.

Introduction

Numerous changes in all segments of social living in the past few years resulted with numerous changes and reform processes in the segment of education. They mostly refer to the need for continuouse implementation of innovative changes and approaches in the educational process introducing certain innovations and innovations in teaching process and the total educational system as well. The crucial issue that arises considering the implementation of changes and innovations in education is how to design the teaching process and how to modify it considering the didactical requirements in a sence to achive the higher educationa effects. Modeling of the teaching process in accordance with the trends and needs of contemporary society inevitably presupposes respect for childrens abilities as well as their development characteristics and the manner they adopt knowledge. In particular, this implies complementary

development in all development segments - motor, cognitive, emotional and social as development as mutually conditioned and equally important; appreciation of the personal experience of the child as the most efficient form of children's learning; respect for the holistic approach to children's understanding of the world as a unified whole; possibility for every child to learn and prosper by it`spersonal tempo and possibilities for improvement; acceptqnce of children as strong, skillful, unique, creative, children that learn and develop through play, research and observation.

In order to achive this, it`s necessary to create friendly, safe, reliable, comfortable and stimulating environment and possibilities for learning, adapted and accessible to every child, as well as creating teaching plans and curricula which include integration, interconnection of different developmental domains, as well as active approach toward the content of all teaching subjects. These requirements express the need for desining and creating so-called thematic curriculum or thematic planning of the educational work (Adamcheski, C, 1998).

As a primary component in thematic planning, ie the creation of so-called thematic curriculum is incorporating various topics from different teaching subjects, which inevitably respect two basic principles - integration and correlation. Integration (lat. Integrare - recovery, adding something to what is important, passage of disintegrated environment in the middle, a subordinate state) which refers to the numerous integration processes and procedures in the teaching process and in the school in general and correlation (lat. Correlatio) understood as a means ratio, correlation, connectivity. From the aspect of teaching process, integrated teaching involves functional connection of all elements of teaching process (contents, psychological, cognitive, social aspect) into a single harmonious whole, while the correlation analyzed in didactic - methodical sence, means mutual connection and impact of educational contents in the teaching process and establishment of functional relations between that have certain similarities and common aspects.

The realization of the various forms of integrative - correlation relation of the contents from same or different teaching subjects within the thematic planning, allowing active approach toward the contents and active learning, acquiring a certain quantum of knowledge that would constitute an integral coherent system; gradual acquisition of knowledge, ie creation of contentual and functional relation between existing and new knowledges, providing a higher degree of permanence of knowledges and their efficient application in everyday life.

According the Conception for nineyear compulsory education (2007), part of the innovations grounded with the implementation of nineyear education, and which are with aim to realize the holistic approach, integral development of children and wholeness of the acquired knowledge,

mostly regarded toward the planning of teaching process, mainly the annual, global planning, which encompasses 70% of the contents of certain teaching subject to be correlated with the contents of other subjects. Considering the fact that the layout of the contents of different teaching subjects in the current curriculum offers excellent possibilities for achieving the required intersubject correlation, the actual practical implementation of this requirement will depend primarily on the skills and the creativity of the teacher. In this regard, in order to show the possibilities, as well as values of intersubject correlation and integration, the aim of this paper is analyzing goals, objectives and contents of the teaching subjects mathematics and physical and health education, to give specific examples, guidelines and solutions how to establish this correlation and integration.

WHY INTERACTION - CORRELATION RELATIONS BETWEEN TEACHING SUBJECTS MATHEMATICS AND PHYSICAL AND HEALTH EDUCATION?

Establishment of integration - correlation relations, depending the content of the teaching subject, more or less is possible among all subjects maintained in the first cycle of compulsory primary education. Teaching subjects mathematics and physical education are part of those subjects, who may establish a range of intersubject and interthematic integrations. They are focused primarily on repetition and fortifaing of the acquired knowledge from the teaching subjects mathematics through various movement games, activities and contents from physical education, as well as authentication of acquired knowledges from mathematics by solving problem tasks for physical and health education.

Using contents from mathematics, students could be familiarized with basics mathematical concepts, symbols, operations; to learn how too solve mathematical and logical problems; to develop logical and mathematical thinking and cognitive activities: comparison, analysis, synthesis, abstraction, generalization, systematization, needed for successfull aqusition of mathematics contents. The contents that are taught the first three years of primary education are the basis for future introduction in complex mathematical shapes and operations that follow in the next years of study. The main goal of mathematics is to develop better understanding for students of mathematical concepts and understanding of mathematical problems, recognizing facts, solving problems that are a result of certain real situations, as well as awakening of critical and creative thinking.

The main goal of the subject of Physical and health education is using different exercises, movements, games and other PE contents to able to strength the body, to improve health,

encouraging habits for a healthy lifestyle; contribute to the development of motor skills and adoption of various forms of movement through which favorably affect the overall development of all segments of anthropological space (motor, cognitive, conative and socio - emotional).

Learning the PHE contents in the first cycle study remains an fortifaing and updating of basic concepts of movement, building of the fundamental movement skills and it`s a foundation for involvement in different sports activities in the further education and life.

The bases of integration - correlation relations between these two teaching subjects we have identified in the application of numbers and measurements as quantitative parameters, particularly, the use of numbers as basic symbols in mathematics and counting as a basic form in determining and maintaining the intensity in physical activity, the use of units time and length; work with data in mathematics as a form of recording success and progress in PHE activities, as well as checking of speed of solving problems, resolving and determining spatial relationships and determination of acquired knowledges in mathematics using different games and PHE activities. Correlation - integration relationships between the contents of these two subjects are reflected in the defined goals for the subjects Mathematics and PHE in the first cycle of nineyears of education. This has its own physiological basis in the functioning of the CNS where the centers for logical thinking and and problems solvina are integratedwith with the centers for motor activity and motor learning (Malina, Bouchard & Bar - Om, 2004). The speed of processing data and information, ie the speed of cognitive processes is directly related to the speed of the motor reactions. These results has been confirmed in numerous studies which confirmed the direct relationship between cognitive functions and results of certain motor tests, primarily the tests for coordination and speed of reaction (Strel & Žagar, 1993; Tirre & Raouf, 1998; Planinšec, 2002 ; Bonifacci, 2004; Pišot & Planinšec, 2005). Obtained results indicate unquestionable relationship and mutual conditionality of the segments of motor and cognitive development (Malina et al, 2004) as well as their relations with all other segments of development (Ismail, 1976). The goals set for the subject's mathematics and PHE in the first cycle of nineyears education is another important component for achieving integration - correlation relationship between these two subjects.

Method of work

Considering the main goal of this paper, the relations between the contents from the subjects mathematics and physical and health education in the first three grades of nine-year compulsory

education, as well as to indicate the advantages, possibilities and forms of integration - correlation relation of the contents, we made analyses of the curicula of these two subjects as foundation for further review of possible correlations between predicted curricula. The paper analyzed: the presence of two analyzed subjects, the purposes for the period from first to third grade, thematic unions and specific content, as well as examples of activities and opportunities to establish integration - correlation relationships between them.

Analysis of the curriculum for Mathematics and Physical and Health Education in the first cycle of primary education

In the first cycle of the nine-year education, or first, second and third grade, mathematics as a separate subject is realized with 5 hours per week, or 180 hours per year. Starting from the academic year 2014/2015, teaching subject mathematics is realized by the adapted curricula of the Cambridge International Examination Centre. It is built on the values of Cambridge and the purpose of its application is students to become responsible, innovative and engaged in an active and creative learning. The mathematics curriculum is structured in five themes named as Numbers, Mathematical operations, Geometry, Measurement, Work with Data and Problem Solving. Within each of the areas, the contents are structured in several different topics identically named in the course of all three departments. These are: Numbers (numbers and system numbers); Mathematical operations (mental strategies, addition and subtraction, multiplication and division); Geometry (geometric forms and thinking, positions and movement); Measurement (money, length, mass and volume, time); Working with data (organization, categorization and presentation of data) and Troubleshooting (using the techniques and skills in solving math problems). Each of the topics is implemented gradually and developes continuously in three periods during the school year. Learning objectives, proposals and examples of activities, resources, or necessary materials and comment are defined within each of noted areas and themes. Designed like this, the mathematics curriculum in the first three years of primary education is a good foundation which can be upgraded in further stages of education.

Teaching subject Physical and Health Education is realized with 3 hours per week, or 108 hours per year. Contents from PHE implemented in the curriculum for the first cycle study for primary education is a foundation for involvement in different sports activities in the further education and life. In all three cycles of primary education, PHE is represented with three hours per week. PHE suriculum is structured in six thematic unions mandatory in first grade named: Get know yourself, Activities for organized lining and movement, Exercises for body shaping,

Bases of Athletics, Bases of Gymnastics and Movement Games. Except the activities from the first thematic union Get know yourself, activities from all other unites are expanded and upgraded in the curriculum for second and third grade. Besides the compulsory themes in PHE curriculum, in all cycles of nine-year education, including the first development cycle provided and selective subjects or topics which are implemented and realized with cooperation with parents. These thematic units are named as: Activities in water, Activities at snow, Cycling, hikes and exscursions, School sports, Sports schools and Sport projects. The realization of the these contents is related with possibilities from the local community, enviorment and it`s possibilities for use.

Opportunities for Integration - correlation relation to the contents of the subjects Introduction of environment and physical and health education

The goals and objectives set in Mathematics and PHE curricula is in accordance with the general objectives of the system of primary education that refers to the harmonious development of students according their individual abilities, development characteristics and and personality development; aqusition of a system of knowledge and skills; effective and creative actions in social and natural environment through the application of generally applicable knowledges in daily life, encouraging intellectual curiosity and creative sence for research (Conception for nine-year compulosry education, 2007). Among the specific objectives for first, second and third grade, as defined in the mathematics and PHE curricula, many integration - correlated relations could be established. Some of them are detailly explained and presented in Table 1. The realization of the stated goals is formalized and specified through three groups of tasks which suggest on numerous integration - correlation relations between these two subjects: mathematics and PHE.

Table 1: Integration - correlation relationship between the targets in mathematics and PHE development period from first to third grade

Subject	*Aim*	*Integration – correlation relatioships*
Math	Count and tells numbers in a row to 100, 1000; distinguishes odd and even numbers (Numbers)	Knowing the numbers, the even and odd numbers, differentiating bigger, smaller, equal and similar, simple mathematical operations, etc. can easily be repeated or determined through various games across movement games and polygons through which children masters new movemnts and learn new skills.
PHE	Encoutrage to develop natural locomotor movements and acquisition of new movements and motor skills;	
math	Monitors and provides guidance for position, direction, movement (Geometry) Differentiate and recognize 2D and 3D	The adopted spatial relations, under / over / left right / front / rear and students alike are used when lining at PHE classes, the group division,

	shapes (Geometry)	movement through space and so on. In the space can move in different ways describing circle, triangle and so on.
PHE	To develop psychomotor abilities through play and physical activity; To develop the ability for coordinated motoric movement and spatial orientation;	
math	Measure and compares length, table with standard and non-standard units (SEM); Undedrstands and uses units of time (Measurement);	Using the units for length, mass and time, students can measure, record and compare their achievements in certain motor tasks and tests and thus monitor their progress and evaluate their abilities and capabilities. In this way they become aware of their capabilities and progress.
PHE	Become able to evaluate their physical capabilities;	
math	Recognizes whole, half and quarter turn in the direction of movement clockwise in reverse	Knowledge of whole, half and quarter, the direction and guidance of the movement allow the students the proper adoption of certain dances and movements to music, movement faster and slower pace, a different rhythm and so on.
PHE	To introduce and perform dances and games in different rhythms and movements;	

Contents provided in mathematics and PHE curricula has it`s foundation in preschool education. These contents are updated, expanded and deepened in the first cycle of primary education, at this way allowing continuity in the acquisition of knowledge in accordance with the developmental possibilities of children and principles of educational work. This process is facilitated by the implementation of the Cambridge program in mathematics and introducing the contents gradually in three developmental stages. This way enables gradual adoption and upgrading of acquired knowledge in mathematics. Their real comprehension could be checked directly, or indirectly through a variety of games and polygons using PHE contents.

The analysis and comparison of contents and thematic unions in mathematics and PHE suggest on numerous opportunities to establish integration - correlation relations, and at this way assuring conditions for evaluation of aqused knowledges and their application in real, everday situations. We based our analyses on contents from the teaching subject mathematics, for which we suggest the possibilities for correlations with themes and contents from PHE. The final form and variations will still depends from the teacher, his creativity and inventiveness.

Within the topic **Numbers** and within analysed numbers and system of numbers, children learn to count to 20, 100, 1000 and a return back respectively, to distinguish small and large, to write the numbers, arranged them in sequence, differ and prescribe steam and odd number, round up to the nearest number etc. All these findings from mathematics can be established, repeated or supplemented by content by PHE. Specifically, in the teaching subject *Organized leaning and movement*, children are placed in a column or row and counting. When they counting children could be given various tasks such as: all children with an even number to move forward a number of steps; all children with an odd number to move back with a number of odd steps. The paths on whichchildren are moving could be marked with even or odd

numbers and accordingly everyone could move in its group on various ways: a straight line, zig - zag, circular, semicircular and the like. The realization of the contents of the subject *Body shaping* inevitably implies a greater number of repetitions of exercises that can be sometimes more than ten repetitions. Different forms of jumps applied as part of the theme B*asics of athletics* offer a great opportunity for repetition of steam and odd numbers predecessor - successor higher - lower etc. Using various patterns drawn on the floor (tile, letter, rainbow, circle, etc.) to which various assignments such as: the steam numbers jump by 2 times, the odd jump 1; on numbers that contain the number 3 jump like a rabbit, those containing 2 jump like a frog, etc., and other similar forms are a great example of the correlation between these two subjects achieved an interesting and entertaining way.

The theme **mathematical operations** includes adopting different mental strategies, learning addition, subtraction, multiplication and division. Mathematical operations addition and multiplication can be improved at interesting ways through various movement games which are realized within thematic units *Basics of athletics*, *Bases of Gymnastics, Games* etc. Such example is the movement game "Divisible with or contain the number" which is commonly applied in the final part of the PHE classes. Namely in this game children are arranged in a circle and begin to tell the numbers from 1 to different tasks, for example, to jump on numbers that contains 3, to jump the number that is divisible by 5 to kneel, swivel, etc. Different puzzles with various mathematical operations can be part of many movement games or simple competitive games where children are divided into two or more groups and are moving throw a given path (polygon) where the end of the path a certain task should be solved. The polygon can be mastered by different forms of movement: walking, rouling, jumping, crawling, climbing etc. While the puzzle can be constructed from operations such as adding numbers, subtraction, multiplication etc. These kinds of games despite the quick thinking at the same time require fast motor response, skills in solving movements tasks, teamwork and cooperation among children. In these games the children's attention is directed to the timing of the task when children are in a situation to think quickly and unobtrusively to solve a mathematical problem.

The thematic union **Geometry** in which several sub-themes are defined: shapes and geometric thinking, positions and movement, is one of the themes in which many integration - correlation relations between mathematics and PHE could be established. The level of aqusition of 2D and 3D shapes, ie their knowledge, distinction and drawing could be determined or learned through different contents from PHE, or movement such as: running, jumping, walking, crawling, etc. on a given path that describes circle, triangle, rectangle. Sorting of different geometric shapes by shape or color can be part of a competitive movement games. The terms

of direction and distance, spatial relationships and movements in space - in front / behind, left / right, forward/backward, over/under, can be learned quickly and easily when are implemented in certain movement games, in different movements and lining in space, all realized as contents from PHE curriculum in the thematic unions: Organized lining and movement, Exercises for body shaping, Basics of Athletics and Bases of Gymnastics.

One of the unions that are taught in mathematics curriculum is the theme **Measurement**, through which students will be able to measure length, mass, volume and time. By measuring weight, height, distance, length with standard and non-standard measures and records the measurement into separate tables and charts as part of the topic Working with data, students learn how to self-measure their achievements in certain motor tasks, eg jump in the distance, high jump, weight, body height, speed running from one point to another, time to perform a certain range, number of repetitions of a particular exercise (push-ups, sit-ups etc.). In this way, children record their achievements, can follow their progress, can compare with other classmates, independently fill theirf personal card for motor skills progress and so on. Hence, this topic is correlated with all topics of PHE in the area of monitoring and evaluation of the achievements of children.

Conclusion

Analysis of Mathematics and PHE curricula, the comparison between the objectives, themes and subthemes, as well as the contents realized at these two subjects, lead to the conclusion that not just that many correlation - integration relationships between their content are possible, yet these types of relations are needed and required ina s sence of children comprehensive development and acquisition of complete and complementary knowledge applicable in real - life situations. The basics of integration - correlation relations between these two subjects, we identified mainly in practical applicability of acquired knowledge from mathematics through their application in the realization of different PHE content, as well as the possibility for a quick check of the knowledge in mathematics through various movement games and polygons with competitions in which the demands of the games is solving certain math problem or task. This opportunity to solve some mathematical problems and quick decision gives an opportunity to recognize children that have a natural affinity and inclination towards mathematics, but have a certain dislike or barrier to it from different reasons. The practical application of knowledge of the type of measurements and compare the length, width, weight, volume, time of standard and non-standard way of data obtained as a result of the assessment of their own abilities, are important in a sence to give the children an opportunity to get know

themselfs, their own possibilities and record their progress. This is particularly important in the process of creation of self-image, to develop self-confidence and self-criticism as qualities that should be built for children from the earliest age.

Despite the evident integration - correlation relations between contents from mathematics and PHE, the relations between these two subjects could be also noted at the mechanisms for acquiring knowledge, as well as the abilities that provide realization of anticipated content. Here we primarily mean on mental abilities such as fluency, speed of solving problem, ability to reorganization concepts as part of general intelligence important to master the contents from math and motor skills, coordination primarily still named as motor speed and intelligence, responsible for efficiency and success in motor tasks and movements. The relationship between cognitive and motor skills is confirmed in numerous studies, suggesting a connection between the segments of cognitive and motor skills development. These relations between all segments of development as well as respecting the developmental capabilities of every child, following their individual needs and abilities, is one of the basic requirements of modern teaching, indicating not only at the possibility, but also to the necessity for establishment of integration - correlation relationships between teaching subject.

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