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THE NEED FOR INTEGRATIONAL AND CORRELATION RELATIONS IN TEACHING WITH EMPHASIS ON SUBJECT CONTENT FROM MATHEMATICS AND PHYSICAL AND HEALTH EDUCATION

Review

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Abstract

The contemporary way of life offers information and facts that require skills and competencies that previously were not needed. Therefore, there is an urgent need for changes within the educational system that will facilitate the adjustment toward the requirements of modern society. That process can be facilitated by the teacher by supporting students for active learning, learning through experience, use of new forms, strategies, and methods of work, and especially by supporting intercorrelation between educational contents.

Correlation between subjects in frames of one subject, but also intrasubject relations requires knowledge from teachers for contents and goals from both subjects, but also a motivation to do this in. This also reflects a deeper understanding of teaching content and applied teaching strategies and affects students' achievements.

During the teaching process, this can be easily achieved by using the approach of integration and correlation that allows the creation of content and functional relation between current knowledge and new knowledge, to foster critical thinking, to a long-lasting knowledge, and the ability efficiently to apply that knowledge and skills in everyday living.

For the needs of our study, we made analyses of the current study plans and programs used in the first cycle of studies (first three grades from 1st to 3rd grade) in primary education in Macedonia, particularly to study programs in Mathematics and Physical and health education. We aim to identify the possibilities for establishing an integration and correlation model in the elementary stage of primary school and benefits from its implementation in mathematics and Physical and health education. The following criteria were identified as basic elements for analyses: the number of classes for each subject, identifying the common standards and common goals for the subjects physical and health education and mathematics, analysis of the thematic units and the planned contents and activities, suggested methods and strategies for work, etc.

Following the analyses, many possibilities for intersubjects' relations were identified. These possibilities were identified within the standards, goals, and suggested subject contents. Applying this model in practice would also mean a greater preparedness of teachers to improve their competencies to foster the quality of their teaching and outcomes from the teaching, manifested in the knowledge and behavior of the students.

Keywords: *integration & correlation in teaching, holistic approach in teaching, teaching mathematics, physical and health education*

INTRODUCTION

The intensive technical and technological development, as well as the dynamic changes that occur daily in all spheres, imposed changes in the educational system itself. The world in which children grow and develop today is fast, dynamic, and full of information, and therefore requires competencies and skills that were not needed before.

To satisfy the needs of students, it is necessary to make changes in the educational system itself, by abandoning the old way of teaching, which is focused on the teacher and where all students should adapt to the teacher and the content. towards a system that adapts to the needs of students (Matijević, Radovanović, 2011) for them to be better prepared for daily tasks, but also ready to function with the challenges of modern society.

That would mean abandoning the classic frontal teaching and reorienting towards modern teaching methods aimed at the student, all to be able to apply the knowledge they acquire in everyday life. The teaching itself and the teaching process should tend to connect the teaching topics with real-life situations. As the environment changes and advances technologically, so do the needs of the students and, accordingly, the teacher and the teaching process, which should try to identify those needs and adapt them to each student following his capabilities and needs

A holistic approach to teaching

Education is of great importance, both for students and for society itself, because it follows the trends of society itself, and at (Matijašević & Matijašević, 2020: p.3).

The insufficient mental engagement of the students, as well as the impossibility of their advancement according to individual opportunities, and knowledge and abilities, negatively reflects on the effective adoption of teaching content.

To better adapt to the changes that occur in all spheres of our lives, it is important that the knowledge that students acquire during their education, be applicable and prepare the student to competently and completely participate and organize his own life. To overcome this problem, it is necessary to introduce innovative methodological models in the teaching process, such as integrated learning, through the integration-correlation approach, which helps the student to study a certain topic or concept better, easier and more thoroughly (Salopek, 2012; Matijašević & Matijašević, 2020: p.3).

The application of this approach can be suitable both in classroom and subject teaching, and requires high competence of teachers, starting from the process of planning, preparation, and implementation of the teaching content. At the same time, the application of this approach requires the establishment of active connections between knowledge and science, applicability and practicality, life, and learning (Nađ Olajoš, 2016: p.15).

the same time leads and directs changes through the education of future generations and young people. Therefore, education must be constantly innovated, respecting the peculiarities of all children, their developmental opportunities, and their potential. Starting from the child as the basic priority in educational work, towards which all educational procedures, activities, and contents are directed, as well as how children acquire knowledge and see the world, as a single entity, the holistic approach in educational work has been developed.

The holistic approach in education leads to an understanding of the world as a whole, leads to respect and development of all segments: motor, cognitive, emotional, and social as mutually conditional and equally important, which leads to the rationalization of the teaching process, contributes to the utilization of teaching contents, leads to greater motivation and activity of subjective factors in the learning process. In an educational context, this means discovering the interdependence of all program areas, all teaching subjects, and all domains of child development as a single indivisible whole composed of several mutually conditioned segments that complement each other and should be equally developed.

Cultural, material, social, and other forms of influence significantly shape the person and his environment, therefore, when learning, it is necessary to take into account the overall image of the person, as well as the world that surrounds him. Learning is an activity that takes place individually but is closely related to specific life situations and experiences, as well as to the narrower and wider social and material-technological environment (Vrkić Dimić, Vidić, 2015, p.3). If in the teaching process, there is no mutual connection between the various teaching contents/subjects, but at the same time a connection with real-life situations outside the school, such teaching could not result in fully understandable and quality structured knowledge. Only by applying general and specific knowledge to practical examples and by connecting with specific life situations and experiences close and familiar to students can a higher degree of integrative learning and teaching be achieved.

A holistic view of the world should be provided through integrative learning. At the same time, it should be based on general civilizational, human knowledge and achievements and applicable in practice, but at the same time, it is important to fit into the image of the world and knowledge that we have built through our life experience. Today, information is available at every step, so we cannot limit ourselves to only one form of education. No form of education/learning (formal, informal, informational) alone is sufficient to build the necessary knowledge. Learning takes place through a variety of life situations and every form of education/learning of a person leaves a mark, i.e. has a specific value (Vrkić, Dimić, 2011b, in Vrkić Dimić, Vidić, 2015:p.3). It is for these reasons necessary learning strategies that will cover all forms of education, as well as learning methods and paths.

To enable the application of the holistic approach in education, there should be an integration-correlation relationship in the teaching process. That integration-correlation relationship allows students to acquire knowledge from the same or similar teaching subjects that have some connection, to be able to form a content-functional relationship between existing and new knowledge, to increase the degree of permanence of knowledge, and to know how to effectively apply that knowledge and skills in everyday life.

Integration as a concept

The principle of interdisciplinarity, i.e. the integration of meaningfully related contents from different scientific disciplines, is one of the most important approaches in educational work because it allows students to build a complete picture when studying the contents, construct knowledge, as well as connect it with previous knowledge (Dolenec, Dolenec, 2013, according to Vrkić Dimić, Vidić, 2015: p.4). If we do not enable students to learn, in which new content will be received through various channels (live speech, printed material, pictorial material, etc.), taking into account the life situations of the students and their possibilities, we cannot expect them to get out of the classroom, as well as from the educational system, with lifelong knowledge that they will know when and in what way to apply it (Mikulec, 2022: p. 15).

The term integration comes from integer/integrals/integrations / integrate (Latin language) and means wholeness, completeness, totality, something that belongs to a whole, that complements it as an essential ingredient/renewal, complementing something with what is essential, the transition from the decayed, scattered environment in a neat, orderly state. It represents the connection of certain parts in the whole due to common interests and for more successful action.

The goal of integration is to acquire, expand, and deepen a complete view of science, art, or the world in general. The task of the teaching integration system is to develop the ability to observe and discover different creative approaches to the topic and its design, to discover common and different components among the natural contents, to develop the creative imagination of students, to develop the ability to compare, critical opinion and logical reasoning (Matijašević, 2020).

The term integration is used in different contexts and with different meanings, such as integration of teaching contents, integration of the child in the educational group, integration of children with developmental difficulties in regular schooling, integrated planning, integrated contents, integrated teaching, etc. Integrated planning is planning that creates, unites, and brings together all content and strategic moments in the educational process, to holistically influence the child's development (Прашања за воспитувачи, МТСП [Questions for educators, MLSP]).

Integrated teaching means the realization of the principles of all the elements of the teaching process (content, psychological, cognitive, social, and organized) to be functionally connected and form a harmonious whole. Through integrated planning in teaching, it is possible to functionally connect the contents of the educational areas or their parts (thematic units), while maintaining their independence, systematicity, and logic. In doing so, it is possible to connect the goals functionally, as well as to process one problem from different aspects. In this way, children can adopt related content from different educational areas and/or topics, in a complete, simple, and interesting way.

Integrated planning is necessary for educational work because (Sivevska, 2020):

- Enables the creation of a stimulating and creative learning environment.
- A positive working climate is ensured.
- Active participation of students.
- Opportunity to express individual abilities.
- High degree of interaction.
- Application of more social forms and methods of work.
- Using multiple sources of knowledge and resources in and out of the classroom.
- Teamwork of teachers.
- Expanding the forms of cooperation with parents.

Correlation in teaching

Correlation in teaching is considered the simplest form of integrated teaching. Correlation (Latin: correlation, English:

correlation) - means ratio, mutual relationship, or connection. In the didactic-methodical sense, it means the mutual connection and influence of the educational work with the students (bringing into a mutual functional relationship educational content within one subject or between the contents of two or more subjects that have certain similarities and points of contact) (Sivevska, 2020). This leads to the realization that students can more easily adopt and connect knowledge from different teaching contents into one whole, that is, they know how to make a mutual functional connection between those contents that have certain similarities or some kind of connection and that they can understand and apply them more easily in everyday life.

The principle of correlation in teaching is realized in several ways (Šimunović, 2006):

• intra-subject correlation (correlation within the teaching contents of a subject):

• intersubject correlation (correlation with certain teaching contents from other teaching subjects)

Each of these two types of correlation can be: horizontal and vertical. Horizontal correlation is the kind of connection of educational content that implies the connection of the contents of different subjects at the level of one age group/class. Under vertical correlation of the educational contents means the interconnection of the contents at the level of several different age groups/classes.

The essence of correlation in teaching is the connection of teaching subjects or their parts "while each subject retains its system, i.e. does not lose its independence", and at the same time, students better understand, act more objectively, and gradually understand certain contents, phenomena, processes, and laws. This would mean a functional connection of materials from different teaching subjects that are similar or complement each other primarily to realize the principle of rationalization and economy (Nađ Olajoš, 2016: p.37).

Implementing integration and correlation in the teaching process brings many advantages. It is precisely with the application of correlation and integration in teaching that the optimality of learning is achieved. Integrated teaching, interdisciplinary teaching, holistic teaching, correlation, thematic teaching, etc. are only "attempts to connect the knowledge of the student's learning process from different disciplines into a whole that explains a certain phenomenon, concept, thought, or topic" (Čudina Obradović & Brajković, 2009; according to Mikulec, 2022: p. 16). The task of the integration-correlation system is to develop the ability to observe and discover a creative approach to the topic being worked on, develop imagination and creativity, discover which elements are common and which are different in the content being studied, develop the ability to logically and critical thinking and reasoning (Salopek, 2012).

Correlation, as well as integration, allows students to easily assimilate the acquired knowledge. In teaching, in addition to the integration and correlation of the lesson itself, an **integrated day** can be organized and implemented. On that day, the contents of several subjects are integrated around a common topic or teaching unit. The duration of this way of working is determined by monitoring the activity and interest of the students, depending on the content (Matijašević & Matijašević, 2020: p.5).

Elementary school teaching, due to its specificities, is the most suitable for implementing integrated teaching. A teacher who plans and controls the learning and study of several different subjects can easily coordinate topics and content during his monthly or daily lesson planning. In subject teaching, correlation is more difficult to perform, but that does not mean that it is impossible, it just requires good team planning and effort (Skupnjak, 2009, according to Mikulec, 202: p. 17).

Implementing correlation in the teaching process is not a simple process but requires preparation. For the connection to be successful, certain prerequisites must be satisfied. Teachers must possess the necessary competencies, innovation, and expertise, but also be motivated for such a way of working. At the same time, the separation that reigns in the subjects, but also between the teachers (especially noticeable in the inter-subject correlation in subject teaching) should be overcome. Teachers should perceive the connection between the subjects, that is, the areas. It is also necessary to adopt plans and programs that will additionally encourage such a way of working, but also to enable teachers to successfully implement the correlation within the subjects and between them (Krželj, 1987, according to Vrkić Dimić & Vidić, 2015; Jović, 2019: p. 27). At the same time, it is important to take into account the psychological bases of the correlation and integration of the program contents, which are conditioned by the age, the development of the opinion, the conclusion, the abilities, and the interests of the students. (Nađ Olajoš, 2016: p.29).

The teaching process in the Republic of North Macedonia and the possibilities of applying integration-correlation links in teaching.

Among the subject connection of contents, integration, and correlation, i.e. the interdisciplinary approach in teaching has a single goal: to enable the student to permanently acquire knowledge and skills and apply them in everyday life. The reason for this is the appeals that are constantly made for changes in the educational system, and the consequence of the poor results that the students show in the results obtained from the PISA[1] research, for the students' below-average ability for reading comprehension, mathematical literacy and literacy in natural sciences (scientific literacy). All this reflects the poor achievements of the students due to the inapplicability of the programs that the students follow, where instead of the applicability of knowledge and skills, superficial reproduction of facts is encouraged.

As a result of the poor readiness of students to apply in real life what they learned at school, which was shown in the previous PISA tests when we were among the last countries, in 2022 a new **Concept for Primary Education** was adopted in our country based on which it began and the gradual creation of new curricula and learning materials that are also digitized, and intensive investment is also being made in equipping schools, which should ensure more

The new concept for primary education (Concept for primary education, 2021) respects the need for changes based on new knowledge for the development of quality education, global and European trends for competency-based education, digitalization of education, as well as all our previous experiences and aspirations to improve the quality of teaching and learning in our schools, which should become a place for learning and development of motivated students ready to acquire the expected competencies. The new concept for primary education offers changes in several areas related to the integration of teaching and teaching subjects, the selection of subjects of interest to the student, learning through research and projects, reducing the burden of teaching materials with factual data, adapting teaching to the needs of all students, using a variety of teaching materials, active participation of students in the life of the school, cooperation and professional development of teachers and motivating them with career development, thus enabling the

[1] **PISA** (Program for International Student Assessment) is an international study that assesses students' abilities, knowledge, and skills in applying what they have learned at school in life situations at the end of compulsory education at the age of 15 mainly in three areas.

opportunity to build a school according to the children.

The novelty of the new Concept for primary education is the definition of national standards for student achievement that determine the competencies that students should acquire at the end of primary education.

According to the innovations in the curricula that have been implemented in the first developmental transition from primary education, the curricula for the subjects of mathematics and physical education from the first to the third grade have been analyzed.

Specifics of subject Physical and health education (PHE)

In the modern age of the internet, TV, and a sedentary lifestyle, it is not necessary to emphasize the need for and importance of physical activity in people's lives. The World Health Organization defines physical activity as any bodily movement produced by skeletal muscle that requires energy expenditure (WHO, 2023). It can be moderate or vigorous intensity, depending on the level of activation on heart rate and breathing. Physical activity is considered any movement that is produced by skeletal muscles that require energy expenditure (Caspersen, Powell & Christenson, 1985, according to Marinčević, 2019).

Physical activity can be done for work, leisure, transport, or health benefits. Some examples of physical activity are walking, cycling, gardening, dancing, swimming, and playing sports. It also implies various activities at home, at work, and at school. Physical and health culture is a subject that is studied throughout the educational system to satisfy the basic human need for movement and shaping an active, healthy, capable, and satisfied student (Mikulec, 2022, p.48).

With physical activity through classes, not only a healthy lifestyle is encouraged. Research shows that a large part of students learn better if they are physically active. Physical activity not only improves circulation and strengthens the musculoskeletal system, but also stimulates the secretion of dopamine and strengthens nerve connections. All these factors allow students to have better academic achievements (Reed, Einstein, Hahn, Hooker, Gross, and Kravitz, 2010, according to Kaittani & sur., 2017, in Mikulec, 2022: p.48).

The contents that are studied in the PHE subject in the first cycle of primary education represent the basis for a healthy lifestyle, so through the application of various physical exercises, movements, games, or other contents, above all, the health of students improves, both mentally and physically, various forms of movement are adopted and all this favorably affects the overall development of all domains (motor, cognitive, socio-emotional). When it comes to the integration-correlation approach, this subject offers opportunities for establishing such relationships with other teaching subjects, especially with mathematics, natural sciences, society, and music.

Specifics of the subject Mathematics

Our life is hard to imagine without mathematics. It has had an important role in logical thinking, opinion, and in general in life since the very beginning of the world. Mathematics is used worldwide today as a basic tool in the study of many fields, including the natural sciences, technology, and art (Mikulec, 2022).

As stated in the recommendations of the European Commission for Education, mathematical competencies are considered one of the key competencies for lifelong learning. (European Commission, Directorate General for Education, Youth, Sport and Culture, 2019; Mikulets: p.11). This includes knowledge of numbers, measures, objects in space, basic mathematical operations, as well as understanding mathematical terms and concepts. The individual should have the skills to apply the basic mathematical principles and processes in everyday life, at home or at work (e.g. financial skills) to be able to think mathematically, understand mathematical proof, master the mathematical language, use everything with appropriate aids, including the processing and presentation of statistical data and their graphical representation, to understand the mathematical aspects of digitization.

Through the correlation of the content of the educational area in mathematics with the rest of the teaching subjects, children are enabled to acquire complete practical, and lasting knowledge and real values. The application of this approach in teaching enables the use of children's potential, respect for individual characteristics, and a holistic approach to the development of the child's personality, but also offers invaluable opportunities for using all available natural resources in the process of forming a complete person with healthy habits and healthy life (Sivevska, 2020).

Analysis of curricula

The curriculum is a concretization of the curriculum, and it determines the scope, depth, and order in which the curriculum will be studied. In the curricula for each subject, the material is arranged by teaching units, teaching topics, and teaching units. The curriculum is a relatively rounded part of the curriculum of a subject. The subject area is divided into teaching units, and each of them consists of more complex parts. The teaching topics are parts smaller in scope than the teaching units, and the teaching unit is material intended to be covered in one teaching hour.

For our research, we tried to analyze the curricula and programs taught in the first cycle (the first three grades) of primary education, to determine the possibilities of applying the integration-correlation model in grade education and the benefits of its implementation in the classes in PHE and mathematics. The number of classes for each subject was analyzed, identifying the common standards and common goals for the subjects PHE and mathematics, analysis of the thematic units, and the planned contents and activities.

Analysis of the curriculum for the subject PHE

The subject PHE in the curriculum for primary education, in our educational system, is a compulsory subject with a class pool of 3 hours per week, 108 hours per year. From the aspect of the achievements and competencies of the students, that is, the connection with the national standards, the key competencies acquired by the students through the adoption of the contents of the PHE relate to the area of *Personal and Social Development*, as well as the area of *Society and Democratic Culture*. Within the framework of the PHE programs in the first development period, several thematic units have been defined (attachment Table 1.).

Table 1.: Subjects/areas in the PHE curriculum

Grade	First grade	Second grade	Third grade
Topic	• Me and my body • I play and do sports	• Me and my body • I play and do sports	• Basics of athletics • Basics of gymnastics with rhythmics and dances • Basics of sports games

Analysis of the curriculum for the subject of mathematics

The subject of mathematics in the curriculum for primary education, in our education system, is a compulsory subject with a class pool of 5 hours per week, 180 hours per year. From the aspect of the achievements and competencies of the students, i.e. the connection with the national standards, the key competencies acquired by the students through the adoption of the content in mathematics refer to the following transversal areas: *Digital literacy, Personal and social development, Society and democratic culture and Technology, technology and entrepreneurship.* Within the mathematics programs in the first development period, several thematic units are defined (attachment Table 2.).

Table 2.: Subjects/areas in the curriculum for the subject of mathematics

Grade	First grade	Second grade	Third grade
Topics	• Numbers and counting • Geometry • Operations with numbers • Measurement • Working with data	• Numbers and counting • Geometry • Operations with numbers • Measurement • Working with data	• Numbers and counting • Geometry • Operations with numbers • Measurement • Working with data

Analysis of curricula and opportunities for applying the integration approach to the contents of mathematics and physical and health education (PHE)

Emphasizing the need for physical activity in a person's life, especially the young population that is still growing and developing, is especially not needed in the age of the internet, television, social networks, and a sedentary lifestyle.

Vazou et al. (2012) also mention some features of the integration of mathematical contents and contents from PHE in the direction of improving the student's intrinsic motivation for work. Namely, they researched to show the positive relationship between mathematics and physical movement. As a result of this, a set of activities called *Move for Thought* emerged, where integrated physical learning activities are offered to primary school students to integrate physical and health culture with other subjects studied in primary school. The activities are designed to enable teaching focused on the academic lesson, while the students are physically active at the same time and are based on developmentally appropriate fundamental motor skills (mostly locomotor skills, jumping, skipping, walking like animals, etc.) that are simple, easy to performance and all with moderate intensity. The results of the research showed the success of the integration of physical activity in Mathematics classes with the improvement of the student's mathematical success.

All this gives an incentive to apply this kind of integration of mathematical contents and the contents of PHE in our educational system.

In the first grade, according to the **Concept for Primary Education** (2021), there is no strict division of classes - the schedule of teaching activities and breaks is determined by the teacher. It gives additional freedom and creativity to the teacher to freely plan and dimension his activities, as well as the opportunity to apply this kind of integration-correlation linking of teaching topics and contents.

Due to cross-subject integration, the teacher plans the activities around the assessment standards of different subjects, but the connection of a specific activity with a certain subject is not emphasized to the students.

The following tables (Table 3, 4 and 5) show an analysis of the curricula in mathematics and PHE and the possibilities for cross-curricular integration in the first three grades of elementary school.

Table 3: Cross-curricular integration in first grade

Subject	**Topic title**
Mathematics	• Geometry • Numbers and counting
Physical and health education	Me and my body

Mathematics	
Topic	**Geometry** *Location, movement, and direction (in front of, behind, next to, on, under, over, above, below, in, inside, outside, in front, back, left of, right of, (closer to), (further away).*
Evaluation standards: • Identifies position among objects in space. • Places objects according to given placement guidelines. • Performs movements in space according to received directions. • Plans (devices) directions of movement in space.	Activities: • Students move along a drawn grid on the floor, according to instructions they receive from others to reach a specific goal. • The teacher visually shows the relationships between objects (front/back; above/below; left of/right of...). • Through a visual presentation, the teacher explains straight and curved (open and closed) lines.
Topic	***Numbers and counting***

	Length, mass, volume (length, mass, volume, inch, cubit, feet, steps, long, short, longer, shorter, heavy, light, heavier, lighter, more, less...).
Evaluation standards: • Estimates length, mass, and volume with non-standard units. • Lists non-standard units for length, mass, and volume. • Uses common non-standard units for length, mass, and volume when measuring. • Compares lengths, masses, and volumes and reports the results of the comparison	*Activities:* • Students (in pairs) measure length, for example: on a tire, a notebook, and a bench..., with a finger and an inch. • Students judge and compare which of two objects is heavier or lighter, for example, two oranges of different sizes, a cardboard and a plastic cube, a wooden and metal spoon, a balloon, and a ball. • Students in pairs count how many times they jump in one minute and compare the results with each other

Physical and health education	
Topic	**Me and my body** *How big am I (height, weight)?* *I turn left and right.*
Evaluation Standards: • Participates in determining your height and weight. • Distinguish between height and weight. • Finds its place independently in the stacking according to height. • It is placed in a column and a row by ones and twos. • Applies left and right rotation.	Activities: • Students line up according to height in a row once from tallest to shortest and vice versa in a marked space (for example, through the games: Walking without collision, Walking behind each other, Predators are coming, Stream, Going to school and coming back from school, Birds on a wire, Earth and water). • Students are arranged by height in a column once from the tallest to the shortest and vice versa (for example, through the games Grablivci, and Potok). • Students determine who is on their left and right (for example, the Saying Names or Numbers game). • The students determine who is in front of them and who is behind them (the Marching game). • Using the seesaw, students are compared by weight and discuss how weight and height are related.

Table 4: Cross-curricular integration in second grade

Subject	Topic title
Mathematics	• Geometry • Numbers and counting
Physical and health education	Me and my body

Mathematics	
Topic	**Numbers and counting** • *Numbers up to 100 (number, quantity, digit)* • *Comparing pairs of two-digit numbers (greater than, less than, > and < signs)* • *Ordinal numbers* • *Even and odd numbers*
Evaluation standards: • Count forwards and backwards from 1 to 100. • Counts by twos, by fours, by fives, and by ten a larger group of objects up to 10 • Uses the terms greater than or less than to compare two two-digit numbers and tells the number that lies between them. • Sort numbers by size up to 100. • Uses the terms greater than or less than to compare two two-digit numbers and tells the number that lies between them. • Explains why he/she wrote the signs > and < when comparing pairs of two-digit numbers. • Sort numbers by size up to 100.	*Activities:* • Each student counts various objects from the immediate environment (classroom, schoolyard) following instructions given by the teacher. • Game Estimates. Transparent bags with small objects (for example: macaroni, pebbles, popcorn, cubes...) are placed in a visible place in the classroom. Students receive sticky notes and write their names, move to the bags, and estimate how many items are in each bag. They write the estimate on the slip next to their name and stick it to the bag. By counting the items, they determined who was the most accurate in their assessment. • Students, divided into groups, count forward, backward, and in other directions on given parts of the hundred table, visualizing patterns of a number system (for example: from 45 to 95, from 60 to 87, from 97 to 27, etc.). • Each student counts a given group of objects (for example spatulas, chopsticks, macaroons...), grouping by twos, by fours, by fives, by ten, again placed in a game situation

	supported by mathematical strategies (counting, multiplication from a smaller number, benefit from a larger number...). • Students, divided into groups, receive two paper cups with different numbers written on them and place the cups next to each other. By turning the cups, they get two-digit numbers, which they write down and sort by size. • Play in the schoolyard. Students group objects and place them in circles, and between each circle, they place the necessary comparison sign (which can be drawn with chalk or made of cardboard). • Students, divided into groups of 10, compete in a run in the schoolyard. While the students from one group are running, the second group writes down the name of the student and the sequence number of reaching the finish line in a table. At the end, they also write down the ordinal numbers in words.
Topic	**Geometry** *Position, direction, and motion (motion, direction, right angle, whole, half, quarter)*
Evaluation standards: • Recognizes full, half, and quarter turns clockwise and counterclockwise. • He names a quarter turn in a circle as a right angle • Tracks and gives instructions for position, direction, and movement using an arrow as a symbol	*Activities:* • One student moves in a classroom or open space on a drawn circle while another student instructs the movement using the terms turn a quarter or half clockwise. • Students fold a piece of paper in half, then in quarters. After completion, they place the resulting right angle on the objects and notice whether there is a right angle on the specific surfaces of the objects in the classroom. • Students receive a sheet of paper with illustrations of multiple objects and use an arrow to mark (connect) the objects according to the given half and quarter-turn instructions.

Physical and health education	
Topic	**Me and my body** • *How tall and heavy am I and how tall and heavy are my classmates?* • *How do I position myself in one and two rows, how do I position myself and move straight and round in one and two columns?* • *I turn left, right, and left in a circle*
Evaluation Standards: • Participates in measuring his height and weight and in the height and weight of his classmates. • Makes a difference between his height and weight and the height and weight of his classmates. • Stands alone in one queue and participates in two queues. • Stands and moves at an appropriate distance in walking and running in one and two columns and a circle. • Applies left, right, and left circle rotation	*Activities:* • The students through the game Who is more difficult? on a seesaw, they compare their weight and then determine the difference by measuring on a scale. • Students line up on a given sign in a marked space by height in one and two rows and then determine the difference by measuring an altimeter. • Students line up according to height in rows from tallest to shortest and vice versa on a marked space through the games: Walking without collision, walking behind each other, Predators are coming, Stream, going to school and coming back from school, Birds on a wire, Land, and water. • Students are placed by height and move in one, or two columns and a circle with a variable speed/tempo (through the games: Locomotive, Predators, Stream, Let It Beat, Little Mimi, Go Cat Beside You). • Students answer a question posed by the teacher about which classmate is on their left and right (through the games: Saying names or numbers, what is on the left and what is on the right of you?). • Students placed in a row or column perform movements and games (Line, March, Train, Drag). • Students compare by weight and discuss how weight and height are related. • At a given sign, the students turn to the left, right, and in a circle (heel-toes).

Table 5: Cross-curricular integration in third grade

Subject	Title of the first topic
Mathematics	Measurement
Physical and health education	Basics of gymnastics with rhythms and dances

Mathematics	
Topic	**Measurement** *Length, mass, volume (measurement of length, mass, volume, centimeter)*
Evaluation standards: • Measures length, mass, and volume and records with standard units of measurement. • Estimates length, mass, and volume and checks the estimate by measuring. • Compares and sorts across a range of lengths, masses, and volumes. • Solves problem situations with length, mass, and volume.	*Activities:* • Students make an instrument for measuring the length from a paper tape (e.g. 1 m, 50 cm...) • Students in groups perform measurements with different types of instruments in the classroom and the schoolyard (bench, chair, blackboard, fence, door, windows, notebook, pencil, etc.). The results of the measurements are recorded in meters, decimeters, and centimeters. • Students work in pairs. Each student measures the height of their friend and writes it on a sticker. The results of the measurement are presented in a table. They answer questions and make conclusions (e.g. arranging the numbers obtained from the height of the students in a sequence that increases or decreases...etc.). • Students in pairs receive photos of different objects (car, tire, bus, school supplies...) where they have to estimate and write down which measurement unit can be used to express their length and explain the answer. • In pairs, students write recipes for preparing dishes. (correct use of units of measurement for mass). • Students in groups choose their favorite recipes and measure the products needed for those recipes. • Students in groups make a volume estimate: Which container will hold more liquid (water)? After measuring with a liquid measuring cup, they check the accuracy of their estimate.

Physical and health education	
Topic	**Basics of gymnastics with rhythms and dances** *Organizational setup (one, two, and four rows and circle)*
Evaluation standards: • It is placed in one, two, and four rows and a circle. • Performs body shaping exercises in different attitudes and positions with and without props. • Performs gymnastic walking and running in rhythm.	*Activities:* • The students of a given character are placed in one, two, and four rows and a circle. • The students of a given sign are placed and moved in one, two, and four columns and a circle. • Students perform body shaping exercises (imitating animals, birds, plants, and objects) in different attitudes and positions.

The benefits of cross-curricular integration are numerous (Bureau of Education Development, 2021):

- Repetition of similar activity is avoided.
- A basis is provided for merging subjects/classes.
- Through the same activity, the assessment standards of different subjects are achieved.

Bearing this in mind, teachers, to rationalize time and resources, as well as greater success achieved in all domains (cognitive, socio-emotional, motor), should make the effort, and of course additionally motivate, to apply this approach to teaching in their educational work with students.

In addition, we will also offer some practical activities that can be useful to teachers in the planning and implementation of teaching with the application of cross-curricular integration in the subjects of mathematics and physical education in grade school.

Examples of games as an integration-correlation relationship between the subjects PHE and Mathematics in the first grade

Game 1.: **Write down ordinal numbers up to 20**

Place of implementation: classroom

Number of participants: all students

Objective: practice writing numbers through the application of a mobile game

Necessary props: 2-3 chalk, blackboard, about 40 pencils, 5-6 chairs.

Description: the students are placed in one row from one end of the classroom, i.e. on the opposite side of the board, because the goal of the task will be for each student to write down one number from 1 to 20 in a row on the board passing through obstacles (chairs). He will also have the task of transferring pencils from one to the opposite box that are located from one end to the other, so depending on the number that he will be able to write on the board, he will need to count and take many pencils from the box and pass (walking) through the zigzag posts to reach the blackboard, write the number with chalk and put pencils in the box.

Duration of the game: each student has to write down one number. When all students write down one number, the game ends.

Motor skills: coordination, speed

Impact of development: improvement of zigzag walking, learning through play, positive emotions, self-confidence, respect for other students, and fair play.

Elements of mathematics acquired: correctly count and write numbers up to 20.

Game 2.: **Even and odd numbers**

Place of implementation: school hall

Number of participants: all students

Objective: through a game, students group the even and odd numbers, and also practice the correct walking and jumping over given even and odd numbers

Supplies needed: 10-20 markers

Description: First the teacher explains and demonstrates the game and divides the students into two groups. The task is to jump in the circles made up of markers, imitating the animals frog and stork, with one group tasked to jump as a stork only when the teacher says an odd number, that group will be an odd number. The other group will be tasked with jumping like a frog and will only jump on even numbers. At the STOP sign from the teacher, they stop jumping and exit the circle and continue to just walk outside the circle (around the markers). While one group (even numbers) performs the task (jump inside the group like a frog) given by the teacher, e.g. no. 2, the other group (odd numbers) goes around the circle and vice versa. Every student who makes a mistake is out of the game, and the group that lasts longer without making a mistake is the winner.

Duration of the game: the game is competitive, so any group that manages not to make a mistake is the winner

Motor skills: strength, coordination, endurance

Developmental impact: adopting the jump technique, positive attitude, competitive spirit, courage, fair play, and distinguishing between even and odd numbers.

CONCLUSIONS

The teaching which is based on connection, the integration-correlation approach is considered as a complete teaching that as a result has quality and permanently adopted knowledge, in contrast to the automated way of acquiring knowledge which prevailed in schools, as the simplest way of teaching. The design and implementation of inter-subject connection by the teacher himself require additional work and time, but the results that this way of working/teaching brings with it are worth the investment (Jović, 2019: p. 13).

Learning based on correlation and integration offers students the opportunity to analyze a particular problem or topic across multiple aspects and several subjects. This kind of learning allows teaching to be approached in a new and original way, creatively. In that way, planning and teaching acquire a completely new dimension, in which there is no template, nor rigid models of articulation of the lesson. In teaching based on the correlation-integration approach, the time organization of the lesson is adjusted to the needs of the students, and the time frame of the duration of the individual stages of the lesson (introduction, main, final part) becomes flexible. (Nađ Olajoš, 2016).

The approach to educational work that is based on interdisciplinary principles can be considered useful and justified if it ultimately leads to effective teaching. The path that leads towards this aim has to be strongly associated with a methodologically well-designed lesson plan, and of course, with well-implemented anticipated educational tasks of the specific teaching material.

However, the conclusions of these articles suggest that various integrative approaches are one of the major ways leading to effective knowledge acquisition (Polić, 2005; Papotnik et al., 2008; Dolenec, Dolenec, 2013).

The content analyses of the curricula in Math and Physical and Health education reveal many possibilities for integration and correlation. Namely, while children are learning about numbers, mathematic operations, and odd and even numbers in Math classes, they can easily and successfully implement them in movement games while performing different fundamental movements. Geometric forms can be also repeated and applied in movements when children are asked to run marking circles, squares, or triangles; create these forms with different objects while moving through the sports halls in different ways- jumping, running, crawling, etc. The idea is to use movement and fun as a basic element while conducting tasks that require some math knowledge. In this manner, children are not stressed that they might be wrong, but they are focusing on enjoyment, being faster, stronger, to be better than the other team, etc. The correlation between math and physical education can be also established when it comes to measurements and comparing the length, width, weight, volume, and time of standard and non-standard way of data obtained because of the assessment of their abilities. According to Popeska & Jovanova Mitkovska (2016), this is important in a sense to give the children an opportunity to get to know themselves, and their possibilities and record their progress. This process is not only related to mathematics knowledge but also the process of self-awareness of children, providing them the possibility to present in numbers what they have achieved in movement, creating this way of self-image, self-confidence, and self-criticism as qualities that should be built for children from the earliest age (& Popeska &Jovanova – Mitkovska, 2016).

With the adoption of the teaching contents through the examples shown, we tried to point out the possibilities for the study of the teaching contents, through inter-subject integration, in an environment in which the students find themselves every day, with which mathematics also gains importance in the students' lives. At the same time, physical and health education becomes more interesting and attractive.

There is almost no thematic unit in educational activity programs in all teaching areas, among which integration-relational relationships cannot be established, which are invaluable sources of knowledge, research, and play. Their application and realization depend solely on the openness of the teaching process to this approach, but also on the creativity and desire of the teachers, on their enthusiasm, motivation, curiosity, creative spirit, and above all, love for the child.

Implementation of integration and correlation can be done easily when working with creative and enthusiastic teachers. In terms of achieving these, we need to work on teacher education within their pre–service education. They need to learn this concept and identify ways and manners of how to do it. After that is left to their creativity and personal involvement how these will be done in practice.

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