European Proceedings of
Educational Sciences
EpES

www.europeanproceedings.com

e-ISSN: 2672-815X

DOI: 10.15405/epes.23056.57

ERD 2022
Education, Reflection, Development

ACTIVATING DIDACTIC METHODS USED IN THE TEACHING-LEARNING OF MATHEMATICS IN PRIMARY EDUCATION

Lavinia Nițulescu (a), Andrea Minda (b)*, Gorița Munteanu (c)
*Corresponding author

(a) UBB University Studies Center from Reșita, Romania, lavinia.nitulescu@ubbcluj.ro
(b) UBB University Studies Center from Reșița, Romania, andrea.minda@ubbcluj.ro
(c) Semenic Kindergarten with Extended Program, Reșita, Romania, gorita.munteanu@stud.ubbcluj.ro

Abstract

The paper analyzes significant aspects specific to interactive teaching and learning, from the perspective of optimizing school performance in the elementary cycle. The experimental research carried out investigates the effects of active-participative/activating methods, adapted to learning styles, on the performance of 4th grade pupils, at the subject "Mathematics", primary level. The study used both qualitative and quantitative approaches and was carried out during one school year, at one of the schools in the municipality of Reșita. Using the VARK questionnaire developed by Fleming and Mills, the pupils' learning styles were identified as: visual, auditory, read/write based and kinesthetic. Consent to use the VARK questionnaire was obtained from Heather Lander, contact@vark-learn.com. The main method used in the present research is the pedagogical experiment, with two samples of subjects: experimental and control, homogeneous in terms of age and level of training. After the pretest, the same content was addressed in both samples, with the mention that in the case of the experimental sample, teaching-learning methods appropriate to learning styles were used. The post-test results obtained by testing knowledge in both samples indicated an increase in the scores obtained by the pupils in the experimental class.

Keywords: Activating methods, learning styles

http://doi.org/10.15405/epes.23056.57
Corresponding Author: Andrea Minda
Selection and peer-review under the responsibility of the Organizing Committee of the conference
eISSN: 2672-815X

1. Introduction

Didactic methodology represents the "operational lever of didactic strategies" (Bocoș, 2017, p. 210), along with the following components: types of learning experiences; pupils' learning styles; motivation for learning; the proposed didactic means; the way of organizing the learning contents; configuration of learning tasks; coordination and monitoring of learning by the teaching staff; assessment and self-assessment methods, techniques and tests; the way of organizing and carrying out the pupils' activity; teacher-pupil relationship etc. (Bocoș & Jucan, 2017). We mention the fact that among these components, essential are: the methodological system, the system of educational means and the way of organizing and carrying out the pupils' activity, correlated with the type of learning experience proposed to the pupils, adapted to their learning style.

Learning style can be defined as a particular way in which an individual learns, with certain habits, strategies or regular mental behaviors about learning, especially deliberate learning, that a person displays (Pritchard, 2017). Fleming and Baume (2006) state that pupils' learning styles can be:

i. Visual: These pupils have a good visual memory and prefer information to be presented visually in the form of charts, graphs, maps, posters and displays. They often use hand movements when describing or remembering events, objects, and tend to look up when reflecting or remembering information.
ii. Auditory: these pupils prefer to learn by listening, but in order for the information to have a personal meaning for the pupils, it must be discussed with them. They have a good auditory memory and benefit from discussions, lectures, interviews, auditory stories. The motivation of these pupils is based in part on the belief that the information has personal meaning.
iii. Reading and writing (making lists, reading textbooks, taking notes).
iv. Kinesthetic: these pupils learn best by doing, through movement and touch. They recall events well and associate feelings or physical experiences with the memory.

Although we all absorb information using all of these modalities, most of us have a preference for a particular learning style. During the learning process, pupils exhibit different styles of observing, sensing, and interpreting information. Personal preferences during learning are described as the person's learning style, and different individual learning styles can be developed according to personal abilities and preferences. Individual differences in learning styles are a consequence of learning requirements and the discipline of study.

In this context, activating/active-participatory methods demonstrate their usefulness and effectiveness, which "emphasize operational knowledge, learning through action, bring pupils into direct contact with real-life situations" (Bocoș et al., 2016, p. 165). "Active-participative methods lead the teacher to create situations in which pupils are forced to use a wide range of mental processes and operations; to consider a multiple approach to what is to be taught" (Cerghit, 2006, p. 69).

2. Problem Statement

The optimization of didactic strategies for the subject Mathematics involves the review of didactic methods and their adjustment to the particular characteristics of primary level pupils, the adaptation of

http://doi.org/10.15405/epes.23056.57
Corresponding Author: Andrea Minda
Selection and peer-review under the responsibility of the Organizing Committee of the conference
eISSN: 2672-815X

some methods taken from other fields to the specifics of education, but also the development of new didactic methods. Among the methods used in the teaching-learning of mathematics, specific to active learning, which can be applied to mathematics classes are: problematization - "the active attribute of education, consists in transforming the instructional act from a relatively passive act of receiving knowledge into a act of permanent search, through knowledge and knowledge, for an answer to a question " (Petrovici, 2014, p. 119) clusters - "variant of brainstorming, of graphic organization of content elements in order to facilitate highlighting the relationships between them" (Mălureanu, 2022a, p. 87), the cube - "one starts from building a cube, on whose six faces are written six well-established commands, in the form of verbs in the imperative form: Describe!, Compare!, Associate!, Analyze! Apply!, Argue!, pupils using different thought processes to answer" (Stoican, 2022a, p. 99), the Venn diagram - "graphical representation method, used to compare and highlight the similarities, the common elements and the differences in the case of the analysis of two or more categories of educational information" (Marzano, 2015, as cited in Mălureanu, 2022b, p. 119), the cinquain - "a form of creative writing that consists in the elaboration of a short text, a poem, through which a given content is synthesized" (Stoican, 2022b, p. 103), the quadrants method - "algorithmic problem-solving strategy. The method involves pupils in achieving the most appropriate understanding of an informational content" (Nicorici, 2013), the multiple station circuit method - aimed at approaching a problem from several perspectives, individualizing and differentiating tasks, but also communication and collaboration between pupils (Vodă, 2022). All these methods allow the configuration of specific tasks, differentiated and adapted to the pupils' learning styles.

3. Purpose of the Study

The present research aims at increasing school performance and school learning success in primary school pupils by using the most effective interactive strategies appropriate to the pupils' learning style to activate them in mathematics lessons. We start from the following hypothesis: the judicious, rational, systematic use of an interactive didactic methodology appropriate to the pupils' learning style leads to an effective teaching-learning process.

4. Research Methods

The following data collection and processing methods were used in the research: observation method, content analysis method, knowledge tests, pedagogical experiment.

The (systematic and participatory) observation method (Bocoș et al., 2021) consisted in the recording in the Observation Sheet of the different behavioral manifestations of the learning styles, caught during the didactic activity of the mathematics classes, under usual conditions. This method was used in all moments of the research, its purpose being to follow the pupils' involvement in mathematics classes, the use of notional language, as well as the degree of completion of the tasks.

The method of content analysis allowed both the research of the products made by the pupils, as well as the analysis of the curriculum documents (curriculums, textbooks, didactic aids for the subject

http://doi.org/10.15405/epes.23056.57
Corresponding Author: Andrea Minda
Selection and peer-review under the responsibility of the Organizing Committee of the conference
eISSN: 2672-815X

Mathematics, primary level) with the aim of maintaining the correct and realistic orientation throughout the whole process.

The knowledge tests used are non-standardized assessment tests, with the role of "determining the pupils' level of competence, their motivation for studying, providing constructive feedback" (Bocoș et al., 2021, p. 134)

The experiment is a pedagogical research method intended to establish causal relationships between activities, practices or procedures, on the one hand, and the variables that respond to these activities, practices or procedures, on the other hand. The present research consisted of an experimental approach to highlight the importance of adapting the didactic methodology to the pupils' learning style. The psych pedagogical experiment was created in such a way as to be incorporated into the training process, taking into account the national curriculum, the school curriculum and the number of hours allocated in the common core. We took into account the planning of the learning units established by the teachers from the pedagogical experiment class, those involved in the experiment throughout it. The research we have carried out is designed as a systematic approach during which we have gone through three stages. In the pre-experimental stage, the level of knowledge, skills and mathematical abilities of pupils from both samples (experimental and control ones) was identified by administering an initial test related to previously acquired knowledge. For the experimental sample, the VARK questionnaire was applied, model, developed in 1992 by Neil D. Fleming. The VARK model classifies learning styles based on the sensory preferences used to assimilate new information and distinguishes between people who learn by perceiving visual elements such as pictures and graphics (visual style), by listening and speaking (auditory style), by reading and writing (visual / iconic style) or through tactile representation of information and body movement (kinesthetic style) – Bhagat et al. (2015). In the experimental stage, the intervention was carried out by introducing the experimental factor in the didactic activities carried out with the pupils of the experimental group (4th grade A, 23 pupils), namely, the use of active-participative methods adapted to the learning style in the Mathematics discipline of pupils. The following methods were implemented: problematization, the cube, the quadrants method, the method I know/want to know/I found out and the circuit of multiple stations, the tasks being differentiated for pupils with visual, auditory, reading/writing and kinesthetic dominance. The Observation Grid has been completed. We mention the fact that the didactic activity with the pupils in the control group (class IV B, 22 pupils) was carried out in the usual way. In the post- experimental stage, final evaluation tests were applied to both experimental and control groups. The evaluation method of the tests was similar to the one in the pre-test stage, the answers to the items in the post-test stage were evaluated by scores, and then the scores were transformed into grades, according to the established performance descriptors. At the end of the evaluation, the pupil's grade was established, depending on the score received when solving each item of the test.

5. Findings

The aim was to highlight the differences between the two groups involved in the experiment, the control group and the experimental group, by comparing the initial results of the pupils with the final results, as well as the results obtained by the two groups during the course of the experiment. The

http://doi.org/10.15405/epes.23056.57
Corresponding Author: Andrea Minda
Selection and peer-review under the responsibility of the Organizing Committee of the conference
eISSN: 2672-815X

comparative analysis of the qualifications obtained in the pretest and posttest stages reveals that, in the case of the experimental group, for which the instructional-educational approach was designed, carried out and adapted according to learning styles, a percentage steep increase is noted. One can remark that the level of qualifications obtained in the post-experimental stage test differs from that at the beginning of the research. Progress was registered in both classes, but more significant in the experimental group. A visible progress can be seen in the pupils from the middle segment, meaning those with grades S (sufficient) and B (well), upon whom the introduction of the experimental factor had a beneficial influence, as they improve their knowledge and mathematical skills. If at the beginning of the research 60.87% of the pupils of the experimental group managed to obtain the grade FB (very well), 30.43% had the grade B (well) and 8.7% the grade S (sufficient), at the end of the intervention, in the same group, there was progress, in the sense that 78.26% of the pupils obtained the grade FB (very well), 21.74% the grade B (well) and no grade S (sufficient) was recorded. The situation is shown in table 1.

Table 1. Comparative analysis of the grades obtained in the pretest and posttest stages

Scores (grades)	Pre-test				Post-test			
	Experimental lot		Control lot		Experimental lot		Control lot	
91-100 (FB) very well	14	60.87	15	68.18	18	78.26	15	68.18
71-90 (B) well	7	30,43	4	18,18	5	21.74	5	22.72
51-70 (S) sufficient	2	8.70	3	13.64	0	0	2	9.09
Under 51 (I) insufficient	0	0	0	0	0	0	0	0

Comparing the arithmetic mean of the scores obtained by both groups, in all stages of the experiment, we observe an increase of 8.37 percentage points in the post-test compared to the pre-test in the case of the experimental group. In the case of the control group, the percentage increase is 2.71 points in the final test compared to the initial test.

We also consider relevant the presentation in of the evolution of the grades obtained by the pupils in the experimental group, related to the dominant learning style, identified through the Vark questionnaire (Table 2).

Table 2. Pretest-posttest comparative analysis of pupils' evolution, related to learning style

	Visual (V) 11		Auditory (A) 6		Read and write (R) (Read and write) 2		Kinesthetic (K) 4	
	Pretest	Posttest	Pretest	Posttest	Pretest	Posttest	Pretest	Post test
91-100 (FB)	7	9	3	5	2	2	2	2
71-90 (B)	3	2	3	1	-	-	1	2
51-70 (S)	1	-	-	-	1	-	-	-
Under 51 (I)	-	-	-	-	-	-	-	-
Total pupils	23							

In addition to the results already presented, the observation grid designed and completed for the pupils in the experimental sample reveals both aspects of a cognitive nature and aspects of an attitudinal-behavioral nature, particularly important from the perspective of skills formation (Table 3).

http://doi.org/10.15405/epes.23056.57
Corresponding Author: Andrea Minda
Selection and peer-review under the responsibility of the Organizing Committee of the conference
eISSN: 2672-815X

Table 3. The observation grid of the pupils' behaviors in the experimental group

No.	Behaviors	Never 1	Sometimes 2	Always 3
1	They do their homework completely and correctly	0	17	6
2	They learn the definitions, rules, explanations, examples immediately after they have been taught	5	15	3
3	They exhibit curiosity, ask questions to understand some information	2	17	4
4	When they make a mistake, they want to know how they can correct it	2	12	9
5	They fulfil their duties and responsibilities	0	3	20
6	They express their opinion	1	15	7
7	To solve a problem, they know how to apply working methods	0	2. 3	0
8	They cooperate with others in group activities	0	1	22

6. Conclusions

The fact that there was an 8.37% increase in the arithmetic mean of the scores obtained by the experimental group, compared to 2.71% of the mean scores obtained by the control group in terms of school achievements, demonstrates the effectiveness of active-participative methods, used in accordance with the pupils' learning styles and validates the hypothesis. Research findings support the idea that pupils with different learning styles achieve better academic scores when they are offered teaching methods that match those styles. Identifying pupils' learning styles and differentiating instructional strategies have the potential to increase academic achievement in primary education. Attention and the ability to concentrate increase in the case of using active methods, adapted to the learning style, methods capable of mobilizing the little schoolboy and awakening his interest in learning. These methods involve pupils directly in learning activities, they become active participants in their own training. The teaching staff has a special role in effective learning, because they must be able to discover the strengths of the pupils and build in them the ability to learn in a wide range of ways. Identifying pupils' learning styles, exposing pupils to a variety of teaching methods, prompts revisions and changes in how instructional activity is designed.

References

Bhagat, A., Vyas, R., & Singh, T. (2015). Students' awareness of learning styles and their perceptions to a mixed method approach for learning. *International Journal of Applied and Basic Medical Research, 5*(4), 58. https://doi.org/10.4103/2229-516x.162281

Bocoș, M. (2017). *Didactica disciplinelor pedagogice. Un cadru constructivist* [Didactics of pedagogical subjects. A constructivist framework]. Paralela 45 Publishing House.

Bocoș, M., & Jucan, D. (2017). *Teoria și metodologia instruirii. Teoria și metodologia evaluării. Repere și instrumente didactice pentru formarea profesorilor* [Training theory and methodology. Evaluation theory and methodology. Benchmarks and didactic tools for teacher training]. Paralela Publishing 45 House.

Bocoș, M.-D. (Ed.), Răduț-Taciu, R., & Stan, C. (2016). *Dicționar praxilogic de pedagogie* (Vol. IV (M-O) [Praxilogical dictionary of pedagogy]. Paralela 45 Publishing House.

Bocoș, M.-D., Stan, C., & Crișan, C.-A. (2021). *Cercetarea educațională. Repere metodologice și instrumentale* (Vol. II.) [Educational research. Methodological and instrumental milestones]. Cluj University Press Publishing House.

Cerghit, I. (2006). *Metode de învățământ.* ediția a IV-a revăzută și adăugită [Teaching methods, 4th Edition revised and completed]. Polirom Publishing House.

Fleming, N., & Baume, D. (2006). Learning Styles Again: VARKing up the right tree!. *Educational developments*, *7*(4), 4. Retrieved on March 10, 2022 from http://www.vark-learn.com/wp-content/uploads/2014/08/Educational-Developments.pdf

Mălureanu, F. (2022a). Ciorchinele [The Cluster]. In I.-O. Pânișoară (Ed.), *Enciclopedia metodelor de învățământ* [Encyclopedia of Educational Methods] (pp. 87-88). Polirom Publishing House.

Mălureanu, F. (2022b). Diagrama Venn [Venn Diagram]. In I.-O. Pânișoară (Ed.), *Enciclopedia metodelor de învățământ* [Encyclopedia of Educational Methods] (pp. 119-120). Polirom Publishing House.

Nicorici, M. (2013). *Dobândirea competenţelor de a rezolva probleme – prezentare Power Point* [Acquiring problem-solving skills - Power Point presentation]. Retrieved on April 12, 2022 from http://dspace.usarb.md:8080/jspui/bitstream/123456789/821/1/competente.pdf

Petrovici, C. (2014). *Didactica matematicii pentru învățământul primar* [Didactics of mathematics for primary education]. Polirom Publishing House.

Pritchard, A. (2017). *Ways of learning. Learning Theories for the Classroom* (4th Ed.). Routledge. Retrieved on March 10, 2022 from https://www.perlego.com/book/2193138/ways-of-learning-learning-theories-for-the-classroom-pdf?utm_source=google&utm_medium=cpc&campaignid=17287656381&adgroupid=134138514222&gclid=Cj0KCQjw1vSZBhDuARIsAKZlijT5d0UfdbNGtN-hrIPqlInbnvsgx-75X7EkrTZkuEBJzeyCY90a5nUaAqYDEALw_wcB

Stoican, O. (2022a). Cubul [Cubing]. In I.-O. Pânișoara (Ed.), *Enciclopedia metodelor de învățământ* [Encyclopedia of Educational Methods] (pp. 99-102). Polirom Publishing House.

Stoican, O. (2022b). Cvintetul [The cinquain]. In I.-O. Pânișoară (Ed.). *Enciclopedia metodelor de învățământ* [Encyclopedia of Educational Methods] (pp. 103-106). Polirom Publishing House.

Vodă, E. (2022). Matematica între bucurie și teamă [Math: turning disquiet into delight]. In O. Bădescu, T. Nitu, E. S. Covrig, I. Vasile, I. Tarchila, S. Gavrila, A. E. Grecu, & H. Perry, (Eds.), *Matematica: între bucurie și teamă* [Math: turning disquiet into delight] (pp. 78-81). Book For LIFE Publishing House. Retrieved on March 10, 2022 from https://www.edumi.ro/wp-content/uploads/2022/02/Matematica-intre-bucurie-si-teama-1.pdf