
15th Edition of the International Conference on Sciences of Education,
Studies and Current Trends in Science of Education, ICSED 2017,
9-10 June 2017, Suceava (Romania)

Studies and Current Trends in Science of Education

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<https://doi.org/10.18662/lumproc.icsed2017.46>

How to cite: Teleman, A. (2017). Specificity of Investigation in Primary Classes. In O. Clipa (ed.), *Studies and Current Trends in Science of Education* (pp. 423-433). Suceava, Romania: LUMEN Proceedings. <https://doi.org/10.18662/lumproc.icsed2017.46>

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Selection and peer-review under responsibility of the Organizing Committee of the conference



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Specificity of Investigation in Primary Classes

Angela TELEMAN¹

Abstract

In intention of modernizing education, the goals are focused on new formative coordinates. Investigative activities include a complex of cognitive processes that allow the process of the scientific content by pupils by mobilizing all their knowledge, skills and attitudes. Exploration/investigation meets three main components specific to the structure of pedagogical activities: constructive component, organizational component and communicative component. Formation of competence of exploration/ investigation must describe its structural components: declarative (savoir-dire), procedural (savoir-faire), conative (savoir-être). Moreover, there were established and described the levels of training competence of exploration/investigation: initiation, certification, and maintenance. To determine the competence level of development of exploration/investigation to pupils from primary school, the tests were applied to each component on a sample of 63 pupils. Exploration/investigation activity of little pupils is an instructive research activity.

Keywords: exploration, investigation, competence of exploration/investigation.

In intention of modernizing education, the goals are focused on new formative coordinates. These involve the restructuring of teaching methods, so as to guide teaching with some strategies centered on a process of observation, discovery and research of the scientific concepts of the pupils. Scientific knowledge is centered on a model in which the essential components of the cognition process were based on assumptions that were to be validated practically.

Exploration/investigation include a complex of cognitive processes that allow the process of the scientific content by students by mobilizing all their knowledge, skills and attitudes.

Theoretical and methodological aspects of studying natural sciences at the primary stage of education through investigation took shape through research on:

- *Ways to streamline the teaching process* (Tarasova, O., 1982; Vinogradova, N., 1994; Sarybekov, M. 1997);

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- *Exploration / Investigation activities*(Gunstone, R., 1991; Campbell, B., 1994; Pligin, A., 2005; Fein, G. 1975; Berlyne,D., 1966; Poddeakov, A., 2002; Shumakova, N., 2004; Savenkov, A., 2005; Semjonova, N., 2007; Lesteva, 2009; Antonova, C., 2009).

The activity of investigation processes and phenomena of the natural sciences in primary school discipline admits different approaches, each targeted to specific groups of essential principles. We summarize these principles groups according to various angles of approach of activity concerned:

- *As a teaching activity* - general didactic principles;
- *Science as a specific activity in primary discipline* - learning principles: from general to specific and vice versa; from simple to complex; the essence of the phenomenon; from concrete to abstract; cause and effect;
- *As an activity for the study of nature* - the principle of spatial distribution (any natural phenomenon or process object a position and a territorial division); structuralism principle (any structure has an internal organization and structure, objects and phenomena are studied in relation to each other); principle of functional integration (any process or phenomenon to be reported as a part of the whole); the principle of diversity (differentiation of the structural, functional and behavioral features of the parts);
- *As a research activity* - general principles of scientific research activity: exploration, simplicity, compliance and sistemicity.

The process of forming the competence of exploration/investigation at primary school pupils in the discipline Sciences admits a modeling theoretical and methodological basis of specific principles (to ensure fairness scientific conditions accessibility age; ethnographic, inter/transdisciplinarity; integration of culture, consciousness, attitudes and environmental performance) and inter-realization on two dimensions:

- Content dimension which is to determine the objects for exploration/investigation of the environment;
- Operational dimension, which aims shaping teaching activities of exploration / investigation of the environment in the lessons of Sciences in primary school.

The scientific approach to the study of nature through exploration/investigation is found in methodological models:

- Training of investigational skills (Semjonova, 2007)
- Didactic support for activities of exploring/investigating (Lesteva, 2009).

Numerous psychological researches confirm the sensitivity of preschool and small school age in exploration/investigation environment, revealing the physiological premises (including righting reflex-R) and demonstrate the natural exploratory/investigational behavior in the youngest age. At a small school age, the activities as observation, identification, description, etc., through which the exploration/investigation of the environment is done, involve a shift to a new stage of development. By Piaget (2005), rational causality is no longer available by deeming their own actions of egocentric orientation, with operations as overall coordination of actions. Some students may meet with an obstacle, that the real returns of deduction and always carries some random behavior. Sensory-perceptual development has specific nuances and manifests itself primarily by amplifying the sensitivity of visual, auditory, olfactory, gustatory, and tactile. Restructuring processes of perception provides the prerequisites for an orientation for a particular purpose, which promotes involvement in training activities of exploration/investigation environment.

Addressing the activities of exploration/investigation of the environment in the study of natural sciences in primary school from the perspective of the general theory of activity has its structure as any other human activity (purpose, motivation, subject, object, means, process, results), but each structural component has some characteristics.

Purpose

There are various views on the purpose of investigative work environment:

- "Understanding the world surrounding us, discovering new information and methods of new activities for students; ensure the necessary baggage and conditions for development, of intellectual and creative students, activation of students, of their cognitive interest formation and capacity to study the general and specific nature"(Semjonova, 2007);
- "Acquisition of investigational skills and those related to research of the interaction between pupils and teachers, targeted at highlighting the essence of the current problems in all subjects and work towards solving this problem" (Antonova, 2009);

Motivation

- There are various views on motivating the activities of environmental exploration/investigation A. Pligin (2005) highlights: cognitive reasons, interest in the subject, communicative reasons; being motivated by the teacher.

Topic

- The study of the task of exploration/investigation of the environment led to correlate with the notion of investigational psychological behavior - an essential feature of personality, which is included in the structure of representations about professionalism in every sphere of human activity, and, moreover a lifestyle of contemporary man (Poddeakov, 2002). Psychological research of investigational behavior of pupils (Fein, G., 1975; Berlyne, D., 1966; Poddeakov, A., 2002; Shumakova, N., 2004; Savenkov, A., 2005) demonstrates:

- The investigational conduct is a form of Behavioral investigation of an object-oriented and based on the need of mental exploratory activism and instructive activity of exploration/investigation, is a type of learning that forms and seeks the investigational behavior.

- The position of explorer/scientist is characterized by:

- The activism of the student in situations of indetermination, conditioned by altruistic cognitive needs, and with the tendency towards independent knowledge of truths;
- The ability to deposit mental and physical efforts in a process of investigation, subject to the need of intellectual activity;
- Preference of productive ways of knowing (Poddeakov, 2002).

Object.

- The study of the environment is not only a call to teach concrete, it has a functional justification, prepares for real life. It must have well-defined object elements that are part of the experience of the child (Gorlitz & Wonlwill, 1987). It identifies three levels of studying nature in primary school (Tarasova, O., 1982; Vinogradova, N., 1994; Sarybekov, M., 1997):

1. The objects of nature are studied separately, without explaining the link between them.
2. The objects of nature are studied in interaction.
3. Are studied not only the objects of nature, also are studied the processes that occur in nature.

Resources

- The resources of exploration/investigation of the environment when studying natural sciences in primary school are determined by factors involved in the activity: subject and object. Point out the below the main scientific ideas actionable means.

- I. M. Fustier (1977) identifies four main ways in which can be explored/investigated the environment:
 1. *Causal approach*: indicate where the problems are generated by disorder;
 2. *Affective approach*: is used when the problem is less acute, more diffuse, if we feel a vague discomfort that cannot be stated more;
 3. *Descriptive approach*: make a thorough description of the environment or formalizes affective approach;
 4. *Schematic approach*: contains the problem in synthetically and structured way, even in the form of system, which highlights the different interactions.
- II. A. Goldsworthy (1998) propose a typology of actions of exploration/investigation applicable in elementary school:
 - *Exploration* - observation through the senses, the situations, processes, objects, creatures and phenomena.
 - *Classification and identification* – investigation that involves grouping objects or events after one or more criteria, or classification of groups of objects, beings, and phenomena after certain criteria.
 - *Systemic Investigation* - investigation that includes observation and recording of natural phenomena or data collection, in comparison with previous data.
 - *Experimentation* - shaping process or phenomenon in order to explain it.
 - *Creating models* - investigation in which students apply knowledge into practice by creating models of various types.

As regards the terms of exploration and investigation we can conclude that the activity of exploration/investigation of the little pupils is an instructive and research activity.

There are also opinions that argue that the methodology of educational and research activity must differ from the science; that in such a sense, the methodology of instructive investigation resume in a simplistic way, the scientific research and doesn't consider developing personal experience of the student. The activity process of exploration/investigation at elementary school age must be according to the age peculiarities of the students.

Based on the analysis of scientific research, we can outline the following descriptions of the stages in investigation activity of the environment applicable in elementary school: goal setting, writing goals in the form of a question; identification of at least three sources of information to answer the question; description of the steps to be taken to achieve the aim; identification of at least five concepts which will focus on the study

work; identification of at least three ways of presenting the results; organizing and planning the activity time; defining how the work will be evaluated.

Generalizing the experience of National Primary Education national, we find that the traditional dynamic of educational activity of exploration/investigation in primary school project to the following steps:

- The teacher formulates didactical task, shows external means of the activity, familiarizing pupils with the algorithm of actions, indicating the organization of the class;
- The pupils perform the algorithm independently in collaboration in groups;
- The teacher guides the pupils in drawing conclusions about and quality of their work.

All exhibited dynamics meet the three main components specific to the structure of pedagogical activities: constructive component, organizational component and communicative component. The problem is:

- Within the *constructive component* the pupils are not involved. They do not participate in choosing the object of exploration/investigation, at writing goals and tasks, at making assumptions and in the preparation of action plan and in choosing methods of investigation.
- At the *organizational component* the pupils' work is supported only via external control, without external corrective activity.
- In the *communicative component*, the results must be assessed only at the level of acquired knowledge and to students' personal efficiency.

Forming the investigative competence must describe its structural components: declarative (*savoir-dire*), procedural (*savoir-faire*), conative (*savoir-être*).

- *Declarative component (savoir-dire)*. To describe the declarative component of the competence we must determine:
 - Corresponding declarative knowledge;
 - Specifics of their use by subjects in meaningful situations.

Ph. Carré (Carré & Caspar, 2004) highlights the following features of declarative knowledge: it concerns theoretical and academic knowledge; it can be learned in the classroom or reading a book; presents difficulties of long-term memory storage; becomes durable only if is linked to procedural knowledge. So to determine the declarative knowledge corresponding to the competence of investigation, we should highlight that information provided in the curriculum, which mobilize in a series of significant didactic situations. As a result, we determined the following groups of declarative knowledge;

- ***All living organisms. Features:*** levels of organization; reactions of

organisms to the environment or to changes in the environment; metabolism; reproduction

• ***Relationship between living organisms and environment:*** relationships nutrition; classifications.

• ***Abiotic factors:*** air and water; ground.

• ***Interaction Human-Environment.***

Specifics of using declarative knowledge of the subjects in meaningful situations is determined by taxonomy of verbal information as pedagogical content objective, thus we obtain a grading sub competencies forming the declarative component on 3 levels:

• **Level A - the notions:** the enunciation of names, facts, knowledge;

• **Level B - of judgments:** the verbal expression of the relationships between two or more events or generalizations (concepts);

• **Level C - of reasoning:** the establishment of relations between judgments.

In specialized literature is recommended to present knowledge, both declarative and procedural in form of matrices, in which scheduling classes shall be graduated (from 3-9 degrees) based on a taxonomy.

• *Procedural component (savoir-faire).* To describe the procedural component of exploration/investigation competence we should determine:

- Corresponding procedural knowledge;

- Specifics of their use by subjects in meaningful situations.

Ph. Carré (Carré & Caspar, 2004) highlights the following features of procedural knowledge: a methodological one; implement declarative knowledge; is assimilated only in a specific framework; store long-term memory easier than declarative knowledge.

Carré (Carré & Caspar, 2004) describes the procedural knowledge: "Since procedural knowledge is assimilated through actions, in most cases, they are described as actions. In fact, there are few differences between the referential knowledge savoir-faire and the referential proper actions. First referential is constituted by helping the verb to know, in front of the main activities of the second referential and thus obtain a savoir-faire idea. " To determine procedural knowledge related to the competence of exploration/investigation, we should determine the main types of actions that process assemblies of significant activities in practicing investigation, highlighted in the curriculum in concordance with the structure and the specific of activity of investigation.

As a result of the analysis, we determined the following four groups of procedural knowledge:

1. **Identify a situation of exploration/investigation:** identify the objective of exploration / investigation; to discriminate what is known from what is to be found; to identify ways of proper exploration/investigation.
2. **Information:** collect relevant information through:
 2. Experiential observations and investigations, according to the specified work algorithm;
 - i. Consult various sources: text, images, charts (data tables, diagrams, plans, maps).
1. **Synthesizing and reporting the results:** organize information in a way that fosters understanding and communication (record-sheets, tables, diagrams, etc.); establish relevant relationships between the obtained information; to formulate conclusions in the form of new knowledge; communicate the conclusions obtained.
2. **Reflection on the activity:** to describe the work done (goal, means, steps, results), highlight the difficulties encountered along the way.

Specifics of using procedural knowledge of the subjects in meaningful situations is determined by taxonomy of intellectual skills as pedagogical content objective, thus we obtain the procedural component on 3 levels:

1. **Level I – the primary intellectual skills:** discrimination, identification, classification, sorting, demonstration, generalization of concepts, characteristics, relationships specified by the teacher;
 2. **Level II – he generalized intellectual skills:** application of rules, algorithms in different situations of exploration/investigation;
 3. **Level III – cognitive strategies:** design the activity of exploration / investigation to solve the problem proposed.
- Conative component (*savoir-être*). Psychological and pedagogical research confirms that "it is practically impossible to describe exhaustively all the conative components of competence, the list would be too long."

Psychological research integrates personality traits related to exploratory-investigational conduct in the position of explorer / investigator personality - an important structure of personality, based on which man not only responds actively to changes in the environment, but feels the need to seek and find what he did not know before. Research carried out by N.Shumakova (Shumakova, N., 2004) showed that the position of explorer / investigator of the student's personality in training represents his position as the subject of investigational type. We highlight the following personality traits that outline conative component, without claiming to be exhaustive:

1. **Sensitivity to the environment**, conditioned by elements by ecological culture and consciousness.
2. **Sensitivity to problems and contradictions**, conditional motivation to ask questions.
3. **Activism in situations of indetermination**, conditioned by altruistic cognitive needs and the tendency towards personal development potential.
4. **Motivation for mental and physical efforts** in a process of exploration / investigation, subject to the insistence of learning and awareness of the reality.
5. **Preference of productive ways of knowledge**, conditional knowledge, anticipation, originality, flexibility.

The study of the declarative component. As evaluation tools we used tests. Development of the tests was carried out based on specific matrices in accordance with the curriculum and declarative component arrays. There were only those contents that the pupils studied until the time of testing. The results show:

Table 1. Distribution of performance levels regarding declarative knowledge

Class	Weight of the performance level (%)			
	D ₁ (insufficient)	D ₂ (minimum)	D ₃ (medium)	D ₄ (advanced)
„A”	17,4	30,4	34,8	17,4
„B”	20	30	35	15

The ascertaining study of the procedural component. The ascertaining study of the procedural component was realized at 3 lessons, based on 2 evaluation tools. The results show:

Table 2. Distribution of performance levels regarding procedural knowledge

Class	Weight of the performance level (%)		
	P ₁ (minimum)	P ₂ (medium)	P ₃ (advanced)
„A”	60,8	34,8	4,4
„B”	60	35	5

Summary of results. Qualitative analysis of the results of the students regarding nominal declarative and procedural knowledge has

allowed us to highlight four levels of training competence of exploration / investigation, each has different sublevels.

- **The initiation level** is caused by a low level (insufficient or minimal) of declarative knowledge declarative and of existing levels (minimum) of procedural knowledge provided mainly by spontaneous experience of exploration/investigation gained in everyday life. Based on the observation of current behavior of pupils and assessments given by teachers, we find that conative component (savoir-être), appropriate to that level, is characterized by a low level of expression of interest for exploration/investigation, of insistence, independence, initiative and creativity.

- **The certification level** is caused by a medium level of declarative knowledge and a minimum level of procedural knowledge, driven by the experience of exploration/ investigation gained at school and in everyday life. The conative component appropriate to this level is characterized by:

- Extrinsic manifestations of interest for exploration/ investigation;
- Sporadic manifestations of the trend towards independence in carrying out some activities;
- The possibility of making productive investigational activities, thanks to the support from the teacher and peers;
- Sporadic manifestations of creativity.

- **The maintenance level** is caused by an advanced level of declarative knowledge and a medium or advanced level of procedural knowledge, caused by the experience of exploration/investigation gained at school. The conative component appropriate to this level is characterized by:

- Stable manifestations of intrinsic and extrinsic motivation to explore/investigate the environment;
- Insistence to achieve productive investigational activities;
- the tendency towards independence and creativity in achieving the activity.

Table 3. Results of the ascertaining study (%)

Class	Weight of the levels (%)		
	I (initiation)	C (certification)	Î (maintenance)
„A”	47,8	34,8	17,4
„B”	50	35	15

Exploration/investigation activity in primary school is instructive research activity.

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