

## **Research Training in an Academic Environment (Scientific-Theoretical Reflection)**

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*With gratitude to prof. George Ivanov, D.Sc.*

**Abstract:** *The study followed modern trends and reasons for the development of research training in an academic environment. The problem is seen in three areas: scientific-theoretical, conceptual and technological. In scientific and theoretical field displays the current context of research training and the need for development of a new class research skills for learning in students. Research is constructed thesaurus that of theoretical and applied level specifying basic concepts in research training. Conceptually direction activity and purposefully constructed cognitive activities are displayed as basic constructs of research training. A specific feature of this study is that the technological level attempt to theoretical and applied reflection of actively supervised teaching experience. Apply the method of secondary analysis of documents and approach "visible learning" research on teaching. Technology research training is represented by an empirical study in which reflection by students providing didactic and values auto control. In pedagogical analysis displayed significant reflections that provide a constructive way for the development of technology for teaching research in an academic environment.*

**Keywords:** *research training, technology, higher education.*

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### **I. The Contemporary Context Of Research Training**

#### *Actuality of the problem*

The problem of research training as a condition of development-relevant research pedagogical competences students is challenging scientific review its ripe topicality in contemporary Bulgarian education. Introduced reforms at all levels and hierarchies of Bulgarian education directed pedagogical science and practice to a new approach for examining and understanding the issues. An approach based on methodological pluralism of interdisciplinarity and globality, which refers to the active and interactive learning, but also takes into account the individuality of the person and talented / hidden talents. Such a scientific theoretical and practical approach that accepts and encourages expression of differing validity rejects imperative and supports research discovery. This scientific-theoretical and practical approach, taken as a common position for the conduct of knowledge, training, education (Radev, P., 2005), here is called - research training. In the whole issue of research training is no stranger in the field of pedagogical sciences. With the development of society needs, goals and current issues to be resolved through the education system change. Today the idea of research training has its practical-applied projections to innovative teaching approaches and strategies to project-based, problem-oriented training to the overall constructivist theory. Therefore in this article research training is seen as a pragmatic innovation model to answer to current projections and understanding of the scientific community to develop creativity, critical thinking skills and transversal competences in the field of teaching and learning in an academic environment.

The National Strategy for Development of Research 2020 (adopted by the National Assembly on 26.02.2015) states that the creative activity of science to benefit society not only involves research that the field of innovation is broader than field research. Innovation (and hence innovative research training) can be regarded as something new in the education or public practice or something old, but improved and more efficient. Given that research training is acknowledged as a second kind of innovation, it is directed first to engage the academic community, building innovative research process in academic training. And this community is made up of two basic symbiotic related parties - teachers and students. In this sense, innovation in academic training has covered a lot of people involved in the academic process. Innovation as a condition for raising the quality of research, logically refers to research training and one of the priorities of the Operational Programme "Science and education for smart growth 2014 - 2020 entitled" in its part to build an attractive scientific environment. It could say that research training through its two activities: teaching and learning, is the current trend outlined in Priority Axis 2. Namely to encourage and motivate young people to complete higher education, organized through innovative academic environment and improved quality higher education. Research training is aimed at the active involvement and creating conditions for inclusive environment (Priority 3). In the context of the academic environment, this goal can be achieved by developing the skills of students to create conditions for inclusive education.

The "Strategy for development of higher education in Bulgaria for the period 2014-2020" is determined that one of the problems related to the quality of higher education is lagging teaching methods of the innovative trends in the practice and development of abilities students; and the need for modernization of curricula.

Important issue for consideration in the article are the conclusions to be insufficient link between teaching and research. Important because research training as a model for training in an academic environment discussed in empirical research of the article proves a verified and test systems for research teaching, learning and research evaluative reflection. A major question that "research training" seeks to answer within the study is how to teach not only knowledge that have an immediate practical application, but also the fundamental knowledge that relate to understanding the world and man, and knowledge whose practical application is delayed in time (simulation-based teaching). Through research training realize the unity of teaching and research, ie basing the training on actual scientific or these projects and active involvement of students in research work. With the adoption and implementation of 01.08.2016g.the Law on pre-school and school education outlines innovative fields that are legal supports and reflections on the quality of higher pedagogical education and hence to research approaches, methods and technologies of training in an academic environment. Already in the delineation of objectives (Art.5) are found important for this article regulatory requirements: acquisition of competences to implement the principles of sustainable development; formation of sustainable attitudes and motivation for lifelong learning; acquisition of competencies for understanding global processes, trends and their interrelationships. The new law establishes a system of concepts, which pioneers a number of future reflections on academic teaching. Shall be regulated:

- Educational Innovation - "innovation and efficiency in pedagogical practices and in the organization of educational process based on scientific merit and forecasting the results of innovation."
- Innovative School - "Schools that achieve to improve the quality of education by developing and introducing innovative elements regarding the organization and/or the content of training; organize new or improved way management, training and learning environment; using new teaching methods; develop a new way educational content, educational programs and curricula. "(SG No.79, 2015)

In this sense a real need and actual projection to the quality of higher education and academic teaching are the development and validation of reliable innovative templates for technological support to the process of educational innovation and development of viable innovative school. Because the application of different innovative models of educational space is inevitably reflected on the methods, forms, resources and the organization of educational process. As for this change inevitably calls for a change in technology through the application of technology and informed choices regarding the organization of learning activities, allowing deployment of creative activity of teachers and students.

The introduction of new curricula in Bulgarian school, the reflecting directly on ways of training of students-teachers. Research training is premised on innovative approaches implicit in them - activity-oriented, interdisciplinary, situational and others. Tasks prospects in the curricula of early stage oriented academic training of students to organize such academic research environment in which to develop pedagogical skills to apply research approach to new learning content. Because new trend in the methodological development of curricula, is precisely the variability and the possibility of organizing learning environment for research students; development through educational content of scientific literacy. In this sense, the actual significance of the research training is seen as a creative search of subjects in the educational process expressed by analyzing the problem, hypotheses for its solution and cognitive reflection of the results and process knowledge.

## **II. Nature of Research Training in an Academic Environment**

Mainly in core research training is a research approach that build on and develop a number of methods, skills, practices that actually systematically organize and constitute the essence of research training. According to Savenkov (Savenkov, A.I. 2006) at the base of research training lie three main factors: Research conduct research (productive) methods research training. Exploratory behavior seen as:

- Behavior aimed at reducing the causes of insecurity (Berlyne, D. 1965);
- Conduct aimed at the search and acquisition of new information (Fein, G., G., 1978);
- A fundamental form of interaction in the real world, targeted at knowledge (Poddyakov, A., N. 2000).

Conduct research, built on the cognitive activity of the subject and context preset create motivation for research. It has direct relevance with research skills as factors for its successful implementation. To develop research skills necessary purposeful learning environment in which the learner entity to develop personal skills for: displaying the research problem; developing hypotheses; observation, experimentation and formulation of concepts. The formation of such skills require relevant productive methods to organize not only the environment but also develop research motivation personality of the learner. Such methods, depending on the nature of cognitive activity are: problem-based knowledge; heuristic methods and research, reproductive technologies - such as border between artistry and creativity (Skatkin, M. N., 1984, Lerner, I., Y., 1981). The classification of reproductive methods adequately disclose the nature of research training:

- Problem method - a method of self-mastery of knowledge-based creative cognitive activity of the learner entity. The technology includes: creating a problem situation; the formation of the problem and hypothesis for solving them; analyzing and applying the results in new problem situations.

- Situational method - based on the introduction of students in a problematic situation, the task is associated with understanding, decision making, forecasting the consequences of this decision, finding alternative solutions;
- Micro teaching - creative teaching method associated with analysis, commentary and evaluation of a fragment of recorded video.

Presented a short reproductive methods outlined research training as a special approach to the process of teaching and learning, built on the skills of self. The main objective of research training is to develop skills in students for autonomous, creative, personal and professional development; skills to design and implement productive methods in their own teaching practice. Another aspect of the research training is conceptualizing its skills to understand and apply scientific concepts and methods in solving certain cognitive problem (Bell, Urhahne, Schanze, Ploetzner, 2010). This understanding directly corresponds with the concept for development of scientific literacy, so learning to think scientifically students to understand the relationship between theory and evidence. The development of scientific literacy as a framework for research training students to engage actively theoretical investigation, problem solving and decision-making set in meaningful contexts. Scientific literacy as part of goal setting in research training involves understanding ú as:

- A system of basic scientific knowledge, the way of their acquisition and development of creative capacity utilization;
- Higher taxonomic ability to describe, explain and predict phenomena and contexts;
- Higher taxonomic ability to use scientific knowledge to questioning, formulating conclusions based on evidence, understanding and problem solving.

Research training in an academic environment aims to provide a methodology for developing skills for successful implementation of the research approach in the context of scientific literacy. The methodological framework of research training can be organized into the following levels:

1. level - initial scientific literacy. In it the students recognize concepts familiar with scientific concepts explained.
2. level - functional scientific literacy. Students understand scientific concepts and can match them with determining context.
3. level - structural scientific literacy. Students develop personal relations and is interested in learning the different scientific concepts.
4. level - multifactorial scientific literacy. Students understand the place of science, understand the interaction between science and the development of society and concepts.

Research training is multi-faceted process involving academic mastery of the teacher, personal development, guidance in a research setting. It is not limited to theoretical knowledge of the research approach. It is something more - research training is to develop skills to contextually use of their fundamental psychological and pedagogical and methodological training, both teacher and student. Use and application of elements of the research approach as constructivist method that embeds learning experiment, group work, search and analysis of information, formulation of research question, does not exhaust the depth of research teaching. The basis for this teaching lies the concept of research, defined as a powerful way of understanding the nature of science. Research teaching is more complicated than the simplified idea of conducting observations and organize them in the summary. It is much more flexible research process than strict sequence of steps generally described in textbooks as scientific method. Survey teaching refers to organize the activities of students in which they develop knowledge and understanding of scientific ideas and understanding of how scientists explore the world. (Doran, R. Chan, F., Tamir, P., Lendhardt, C. 1996). In fact, research teaching scientific self-reflection is linked to mastery of the teacher. Reciprocal interest in this training is exploratory learning in which students are introduced. Their self-reflection on educational discovery is the result of the procedure through the levels of research learning. It - educational discovery in itself can range from detecting implicit model to participate in simulations. Exploratory learning requires students to have accurate / correct answer, it suggests that answer be found in and through training materials, case studies, situations. The research study is related to the creation of conditions for problem solving in students, based on their own teaching experience (even if reduced) and theoretical knowledge interact with the environment, examine, manipulate objects, experimenting. Research learning allows students like real scientists to examine and explore the world, to make their own observations, to collect and analyze data and to offer explanations for their own work, based on scientific evidence. The students learn how to ask questions and use evidence to respond to them. In the process of learning strategies of research students learn to conduct research to explain the collected data to present and defend their conclusions. The teacher carefully monitor, classify and analyze the facts develop and verify hypotheses to explain their conclusions. (Hunt, E., Colander, D., 2010). The research study develops students' discursive skills to use mathematics, natural science, digital and functional ethical literacy. This is actually a guarantee for the formation of professional mobility in the future educators (opportunity to learn new skills) and for easy adaptation to rapidly changing needs of the education market.

### III. Empirical-Activity-Based Structure Of The Research Training

The essence of research training outlines the Activity empirical and applied research methods such as basic research in learning and teaching. In this sense, outlines the basics of empirical activity-based structure of research training.

#### A) *Tasks theoretical structure separate from the activities of the teacher:*

- *Situated on the problem and formulate hypotheses:* teacher does not begin with a statement and a question. Situate problem / real case. This allows students to seek information and to participate in the management of research processes. Students are engaged by scientifically oriented / problem-oriented questions. They ask questions, collect data, make educational discoveries.
- *Empirical research:* teacher sets of inquiry as a priority and allows students to develop a scientific worldview, evaluate responses to scientifically oriented / problem-oriented questions.
- *Empirical meta-cognitive activity:* teacher requires students to synthesize information, formulate scientific answers and solutions to situate problem or a real case. This leads to the understanding of scientific concepts, scientific methods and develop research skills.
- *Research propedeutics:* The teacher organizes a research environment in which students evaluate the responses and evidence in light of alternative scientific concepts.

#### B) *Tasks-empirical structure separate students according to level of involvement:*

*Verified Research inclusion.* The activities of the students are related to the previously provided relevant information. The teacher manages the process of research, provides guidance throughout the process. Decisions, actions and responses, students choose their own.

- *Initially structured study.* In this activity-level teacher provides the necessary information for research problem and the appropriate test method. Students work on a decision by the collection and analysis of relevant data. This type of structured study points to initially develop research skills.
- *Essentially structured study.* In this activity-level teacher provides the necessary information for research problem and provides various methods of research. Students independently choose methods and work on the problem.
- *Led the study.* Here the question or hypothesis is still provided by the teacher. Students generate ideas for scientific solutions supported by scientific evidence. The teacher asks only research question or hypothesis and students create procedure / method to test questions / hypotheses and responses received under the guidance and / or support of the teacher.
- *Open study.* In the open-label study, students have the opportunity to act as scientists / as their teacher. Sammy must define hypothesis, method and procedure. Required actively questioning, designing and conducting research as well as commenting on their achievements / failures and results. Here, students must present their own scientific reasoning and beliefs, to provide pedagogical competences in the field.

#### C) *Tasks-empirical structure, according to technology research training:*

*Case technology.* The specifics of teaching through case studies require their educational application in academic environments become once students have a minimum of scientific knowledge. Or otherwise are in the process of forming the initial scientific literacy. In this sense the case in technology research training is applicable to activity-theoretical-empirical structure, metacognitive, research and propedeutics. A major element of the technology of case-teaching is the use of teaching cases in the process of teaching research. Didactic training studies (Neminska, R. 2015) aim students to acquire, develop and apply a set of skills in the training process. Through them organize research environment in which students develop and underlying but those are likely to be used less often or assume that there will be no environment in which to develop. This helps students to foundational practice such skills that they could not get otherwise. Important relevant supports teacher when constructing didactic studies for technology research training are not only scientific and disciplinary problems, and also: the historical context of the situation, relations between individuals or groups involved, religious background and perspective of the situation, sociological, economic and educational factors.

*Draft based technology.* The draft-based technology research training is training model focused on the teacher. In didactic plan it is based on the method of projects proposed for the first time since. Dewey and Kilpatrick in 1918 (Dewey, J., 1916, Kilpatrick, WH, 1918) and is based on the idea of "learning by doing. As technology research, however, it is based on carefully planned by the teacher interdisciplinary competency training to develop skills in high-integrity problem situation (Gyurova, V., 2006). The draft-based technology research training is all in one activity-motivational-trial, pre-planned, implemented and managed by the teacher in school academic environment. The purpose of this technology is:

- Developing the research skills of students for managing the learning process in implementing the method of projects.

- Developing pedagogical flair to the selection of methods. (The question of the choice of appropriate methods is fundamental in managing the effectiveness of the learning process. It has the role of organizing and controlling factor and the need to develop pedagogical research skills for selecting not just one but a combination of methods).
- Ability to work with specialized literature and self-study of selected material.

*Problem - based technology.* As a modern pedagogical philosophy problem-based learning (PBL) is increasingly recognized as a major area of research and pedagogical innovation in science. Research interest raises new field of emerging educational problem - based technology (Jin, J. Bridges, S., 2014). Therefore the organization of problem-based technology research training directly corresponds with scientific self-reflection of the teacher. At the core of problem-based technology research training lies the problem-based learning approach. This is a dynamic approach to learning that enables students to explore alone scientific, methodical, didactic problems. Focuses on the diversity of scientific concepts and strategies rather than factual solve.

It follows that problem-based technology is purposefully planned research, academic review process of scientific knowledge in order to develop a functional scientific literacy to structural scientific literacy. Problem-based technology research training is all in one activity-empirical process, pre-planned by the teacher, but implemented and managed by students. The aim of this technology is the development of students:

- Research skills with scientific kotseptsii, strategies and constructing empirical study models.
- Research skills for the implementation of methodological pluralism;
- Skills for selecting the literature and specialized self-study material;
- Flexible management of their own acquired knowledge.

*Interdisciplinary technologies.* Interdisciplinary research technology is the integration between scientific concepts, teaching strategies and disciplines. Develop skills to manage technological resources of different but compatible disciplines / educational subject fields. Conceptually it is seen as a system of active reproductive and integrating be disciplinary approaches through which solve problems in complex situations; Competency is associated with interdisciplinary skills. In the field of interdisciplinary research training technology has the competence to function as a bridge between structured and multifactorial scientific literacy. Interdisciplinary literacy is a skill to investigate a problem across the borders of disciplines and in a pluralistic dimension of science. Hence the purpose of interdisciplinary technology: building a foundation of scientific knowledge, patterns of variability, methodological mobility, scientific perspectives and strategic freedom of choice.

*Simulation-based technologies.* Simulation-based training in planned and targeted simulate professional reality in which students receive educational opportunity to experiment and multiply knowledge and skills. This is a practical research training, which mimic or construct a holistic educational environment. With its contextuality develop in students adequate, flexible and adaptive social - pedagogical skills. When planning educational simulations in simulation-based training in a systematic approach as thus rank simulations recurring items, ranging in difficulty simulations, integrative simulations hierarchical developing simulations. Depending on the purpose of research training construct a simulation-based technology by selecting the type of educational simulations.

*ICT - based technologies and social media.* Technology plays a special role to support research training and in the transformation of academic teaching. To clarify the context in which technology supports research training should note two important features:

- Technology can be seen as an object of study or as a tool for learning.
- Can serve as a catalyst in conventional practice, or as a translation agent.

ICT technology and social media create new opportunities to engage students in learning survey (Krajcik, Marx, Blumenfeld, Soloway, & Fishman, 2000). When designing the research learning using ICT technologies and social media can focus on the impact of simulation training; research and discovery in traditional areas. (Barstow, 2001). World Wide Web can provide access to older scientific work in the form of reports, data, presentations and articles, together with the latest ones on the same subject, offering the opportunity to explore how to create scientific data, models and theories modified and refined over time. In this sense, students are assisted in the development of multifactor scientific literacy - to understand and analyze the changes in scientific concepts through the development of society.

Tools such as sensors, mobile phones and portable devices allow learners to interact directly with the environment and to collect new data within the academic timeframe. Social media and other communication tools such as wikis, blogs, emails, etc. facilitate communication between students, teachers and researchers, provide access and create communities, which in turn creates additional potential to enrich the research training. In a research dissertation (2016) V. Georgieva reaches conclusions that the impact of social media on the socialization of Bulgarian students and teachers clearly shows that all three groups of respondents considered the technology themselves as a suppressor of attention. In this sense already "necessary to seek thoughtful,

constructive and balanced dosed way for formal presence" technology and social media in formal education - through research training (Georgieva, V. 2016).

#### **IV. Technology Research Training In An Academic Environment(Empirical Study)**

This empirical study is based on actively monitored and systematically traced scientific experience in academic teaching students - first-year teachers. Technology research academic teaching is perceived as an interactive matrix, because at the time of its active surveillance - three academic years (2013/2014, the 2014/2015, the 2015/2016.), It flexibly adapt to the attitudes of each new class, but retains its authenticity and original research originality. Author of this technology research teaching is **prof. Georgi Ivanov D.Sc.**, Trakia University, Faculty of Education, Stara Zagora.

##### **1.1. Conceptual design of research training**

Cognitive activity is highly motivating factor in research training. But in fact, without it, and without developed creative skills is almost impossible entry in the modern pedagogical and educational environment. The rapid development of high-tech means begins to "control" and guide the intensification of scientific knowledge and the quality of its creation. In this sense, knowledge goes from just outside the school and academic environment and increasingly takes another format. In the sense of continuing education and self-management cognitive activity combined with the autonomy of the individual and the responsibility for decision-making under conditions of risk and dynamically search for solutions. Therefore pedagogical research look at organizing learning environment focuses on planning tasks to develop the creative skills of students, stimulating cognitive activity, independence, self-education skills and readiness for inclusion, creation and development of innovative activities and pedagogical research. In this context construct specific learning environment for research teaching and learning of freshmen students in discipline "Primary Education" programs: "Preschool and Primary School Education" and "Primary School Education with a foreign language."The structure of the training is developed through a systematic, comprehensive hierarchical approach. It clearly distinguish four levels of teaching strategies - operational, activity-related behavior, didactic and behavioral auto strategy (Merdzhanova, Y., 2005). Operating didactic strategy is aimed at personal reflection, motivation, expectations and prospects. TASKS didactic strategy is aimed at developing pedagogical research skills. Directly corresponds with the concept of scientific - research. Students are introduced into the draft - based organized environment-related academic subjects. School projects are constructed in a way organizing to develop a number of research skills - selecting information sources, pedagogical decision, pedagogical and these hypotheses. Realization of scientific - research activity in the project - based environment of students leads to the creation of a research project. Behavioral didactic strategy is implemented through problem - oriented environment and simulation-based educational training. Students are involved in the problem - research and develop skills for public presentation in pedagogical audience pedagogical vision and behavior in the educational environment; upgrading skills in information technologies and techniques. Realization of scientific - research into problem-oriented environment of students leads to the development of observable competencies (Neminska, R., 20015). Auto didactic strategy is directly relevant to the problem oriented training self-assessment, pedagogical reflection and self-reflection, Autocorrect related analyzes, methods, choices and decisions. Realization of scientific - research in simulation environment of students leads to the development of primary scientific - research skills.

**Table 1. Conceptualization of the research activities of teaching:**

<b>Scientific and theoretical level</b>	<b>Action - research level</b>
The study fundamental knowledge	What is known for teaching practice?
Setting goals for students' education.	What do we want students to learn?
Develop a hypothesis for achieving the objectives of the training.	How can we help students succeed with the learning objectives? Or how students learn?
Determination of criteria for success.	What evidence criteria will be set to determine whether students achieve educational goals
Development and implementation of educational models within the experimental design.	What will we do to enable students to achieve the objectives of the training?
Collecting and analyzing data.	How will collect and analyze information to determine what students have learned?
Reflection, evaluation and implementation.	How will we use what we learned to improve our teaching?

##### **1.2. Basic concepts of pedagogical research training(Empirical thesaurus)**

The quality of research is constructed empirical pedagogical thesaurus of terms directly characterizing the processes and activities in research training. This need arises from the fact that various sources, these relational concepts are interpreted in different contexts and gives the impression of a moving away orderly and clarity. Conceptual vocabulary is valid in the present empirical research and aims to:

- Clarification and use of specific terminology in a flexible and adaptive scientific and theoretical process ;
- Pedagogical context of concepts.

*Science - research pedagogical activity* - a systematic, creative work to create connections and relationships between educational phenomena, the knowledge of educational laws and to promote their practical application in a real teaching environment. Research pedagogical activity is creative activities to new knowledge and methods of their application. Scientific pedagogical activity - activity aimed to study describing, retrieval of new pedagogical phenomena, relationships, concepts, technologies and use this knowledge to develop new ways for their implementation. The research activities rely on research and development.

*Scientific - research students* - activity-related - technological projection of research training. It is connected with the achievements in the examination of educational research problems; aimed at creating an idea of pedagogical phenomenon under the guidance of academic tutor. Scientific - research students includes work in pedagogical problem area including variables special design or structure of the environment; skills for formulating hypotheses; ability to work with different types of materials, methods, skills analysis and selection.

*Research skills in educational contexts* - Ability to specify the problem to generate hypotheses to carry out observations and experiments to construct definitions and empirical concepts.

*Research the culture of the teacher* - an integrative, dynamic personal and professional process with direct correlation to educational values, research methods, creative activity and self-esteem to self-development innovation.

*Research culture of students* - dynamic, personal status that characterizes the student by the intensity of training and cognitive activities, attitudes and knowledge of techniques, technologies and variants of their application.

*Research process* - A system of methodological tools for collecting, processing and interpretation of data pedagogical tasked to assist the development of management decisions, to solve problems and discover new perspectives.

*Method Project* - a way of active and effective management of research activities through the development of skills for working with concepts, management training and research processes, achieving results; form of organization of educational process in which students acquire skills for planning and implementation of practical tasks.

*Research project for students* - a specific form of scientific research. The main goal of the research is to get an idea of certain pedagogical phenomenon or problem.

*Draft - research* - applying skills for planning their own research, distribution objectives, tasks, methods; design research development, resources and expected results; assessment and self-assessment.

*Problem learning* - teaching method for organizing activity-related subject-subjective environment in the context of which presents situational problem case; in this environment, students become part of the scientific knowledge and methods for their creative application, develop models of research thinking.

### **1.3. Aim of the study:**

Approbation and verification of technology research pedagogical teaching in an academic environment.

### **4.4. Objectives of the study:**

1. To model the concept of the study based on an analysis of scientific-theoretical ideas and trends in literature.
2. To form a toolkit for empirical verification:
  - Monitor the development and influence of factors and elements on technology research training;
  - Authentication of research achievements.

### **4.5. Object - subject area of study.**

Object of study: technological process and methods of research technology for academic teaching.

**4.6. Subject of research** is the efficiency of technological procedures, expressed through reflection and self-reflection students.

### **4.7. Methodology and tools of study**

A) The main research method is modeling. It applies to the creation and testing of:

- complex problem-research tasks characterizing research study (considered as part of technology);
- systematic organization of comprehensive research environment characterized research training (considered as part of technology).

B) Research questionnaire. For the purpose of the study is designed questionnaire containing 20 questions. (Appendix 1).

The research objective categorize three sets of issues that define meaningful research criteria:

- 1) related technology research learning;
- 2) related technology research teaching;
- 3) associated with personal reflections, assessment and self-assessment of students.

The questionnaire is viewed as tools for the application of modeling as a research method. The questions are designed in a way that puts the respondent in an active position. On the one hand he justifies and proves its response to the other questions explore the shades of the same pedagogical problem. Students are placed in three simulated research communities - to explore their own learning, evaluate teaching, to express feelings and emotions (reflections).

The survey was conducted during the 2015/2016 academic year with 55 students, specialty "Preschool and Primary School Education" and "Primary School Education with a foreign language" learning course "Primary School Education. The questionnaire is completed by the students at the end of the academic year. The aim is for students freely and without unnecessary worries to express their own opinions, attitudes and recommendations to the form and process of research learning and teaching. And also, this is a time in which the student has done and realized their first steps; he has overcome obstacles; he realized the extent of their own growth and development of research skills. Technological time to travel the path of learning research to understanding the results and deferred benefits give rise to real and constructive pedagogical reflections with students.

#### **4.8. Research criteria and indicators**

As part of a broader study here empirical data and results are processed only through percentages and graphics. At a later stage is scheduled to perform correlation analysis and dichotomous scaling. The evaluation criteria are empirically meaningful character. They are reciprocal taxonomy of issues identified in the description of the tools. Through the concept of meaningful research training criteria are outlined in activity-related and reflexive indicators.

##### **First criterion: Technology research study.**

*Activeness indicator:* stimulation of active students in pedagogical problem area including variables.

*Reflexive indicator:* research skills to formulate hypotheses; ability to work with different types of materials, methods, skills analysis and selection.

##### **Second criterion: Technology research teaching.**

*Activeness indicator:* organized, productive and adequate research environment through problem-orientation and simulation-based educational training.

*Reflexive indicator:* successfully manage technology and stimulate expression of pedagogical reflection in the research context.

##### **Third criterion: Science - research self-reflection.**

*Activeness indicator:* skills for research reflection and correction in pedagogical activeness angle.

*Reflexive indicator:* skills for self-reflection and autocorrect activeness in pedagogical perspective.

## **V. Research Data And Results. Pedagogical Analysis**

### *Data and results*

In assessing the reliability, validity and reliability, analogously: results and analysis should be assumed that they are constructed primarily through secondary analysis of documents. It does cut and analyzing part of the process, the target group and tools. At a later stage the presentation of complete approbation and verified technology and results from it. The research results are presented in three groups (research criteria) with empirically derived meaningful indicators. In the concept of research learning and teaching cognitive activity is displayed as the main form, and hence the presence of factors such as motivation, stimulation, supportive environment. Therefore, when displaying data focuses on the activity expressed by the students. In the pedagogical activity analysis that will be discussed in the context of personal, educational and research reflections expressed in the responses of the students.

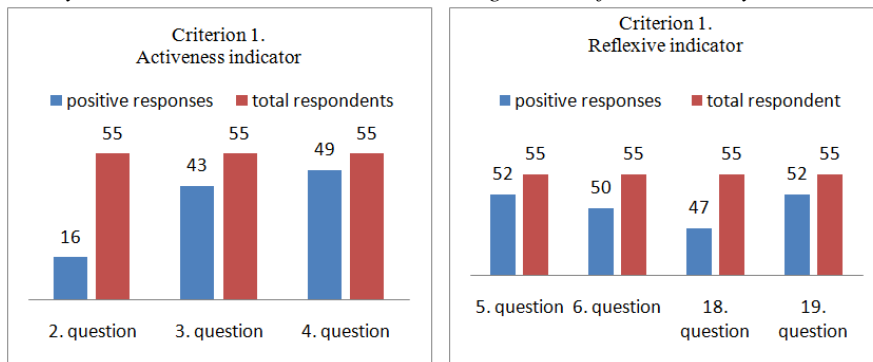
*Criterion "Technology research study"* includes seven questions (2, 3, 4, 5, 6, 18, 19..). They explore the characteristics of technology in learning derived empirical indicators. Data are presented in graphic images, so be visualized to action and reflexive activity of students.

*Activeness indicator* - instruments and their application rules and their compliance criteria and formative assessment (2, 3, 4 issues).

*Reflexive indicator* - evaluation, selection and methodological perspectives and personal technology (5, 6, 18, 19. Questions).



Figure 1. Activity on activeness indicator Criterion 1 Figure 2. Reflexive activity indicator - Criterion 1

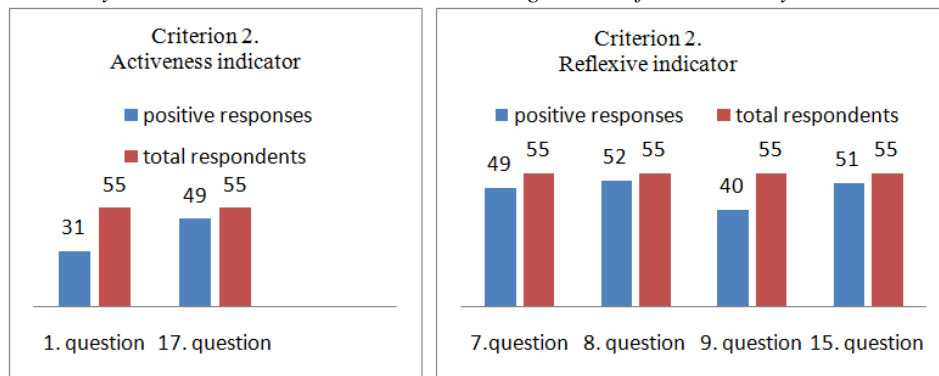


In the Activity indicator second question: "What do we hinder the development of projects? - 29% (16 students) responded that they had no difficulties to use tools for learning research. The responses of the majority, however - 71% are specified difficulties such as writing the pedagogical essay selection of information; determine the specific time as a stressor. Finding and working with information and the use of scientific arguments impedes 20% of surveyed student group. Organizing educational activities in technology research training emerges through the answers to the question third - "Did uncertainty regarding the self-assessment and the requirements for clearance of projects?" - 78% (43 students) meet the criteria, conditions, terms and activities are presented in a clear and understandable, and 22% (12 students) responded that they have not understood the nature of activities - "what to do in these times." The preliminary guidance to the specifics of academic preparation is distinguishable by the fact of asking: "Requirements for design of projects you correspond with the character of your academic training?" (question 4). This in turn opens the research context guidance technology learning to the training of academic audience as the technology has preemptively reflexive nature. Students assessed with high research regarding: form and substance - 89% (49 students) answered positively, and 11% are not functional relationship.

Reflexive indicator reports that 92% of students consider research on educational projects suitable for checking the level of their academic preparation (5 issue.). This response directly correlated with positive answers 90% of students that prefer to be taught by the form of projects (6 questions). In this sense, as the development and completion of the entire cycle of research technology, 86% of students support the reflexive-active approach for verifying the academic preparation - "through analysis of individual results of the project" (18 questions). An important fact about teaching analysis is that 10% of students did not answer the questions, which is not necessarily negative. Half of them indicated that they prefer to be checked by productive-heuristic approach - examination tickets.

Second criterion "Technology research teaching "includes six questions (1, 7, 8, 9, 15, 17.): They examine the characteristics of the technology of teaching performance. Data are presented in graphic images - on indicators that can be displayed to action and reflexive activity of students. *Activeness indicator* - preliminary attitudes, techniques, tools (1, 17, questions). *Reflexive indicator* - formative assessment (7, 8, 9, 15., Questions).

Figure 3. Activity on activeness indicator- Criterion 2 Figure 4. Reflexive activity indicator - Criterion 2



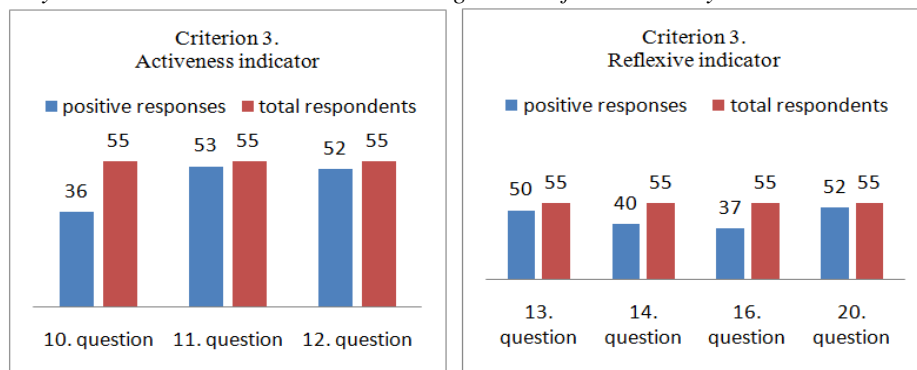
In the second criterion to action index directly associated with activity-related strategy and reflection on the specifics of research Teaching. He said through the answers to questions 1 and 17. First question: "Do you have expectations to develop projects in this discipline?" Is aimed at exploring advance expectations of students for technology training. Of these, 56% (31 students) had a pre-disposition / but not declared skills, which can be

seen in correlation with self / work in research technology, the other 24 students - 44% responded negatively, i. e. had no prior attitude and information to work on this technology. Question 17 "You get to evaluate the expression on your project by the teacher, expressed in an unconventional way (use of hyperbole, jokes, banter, transmission in absurd situations, etc.)? Describe your attitude to this kind of evaluation by your personal experiences ", 89% (49 students) reported that non-traditional way of teaching and assessment in the process of research study helps to overcome stress, fear, embarrassment of a public presentation; stimulate motivation, allows for overcoming and understanding errors. In this sense the activities planned for research teaching in an academic environment are highly appreciated by the students.

Reflexive indicator is directly related to the process of formative assessment through research activities in teaching. In this case it can be seen that reflexive indicator raises deep personal reflection and teaching students through the Activity feature of teaching. Respondents to the eighth question: "If the shape of academic training is different, how you hurt?" - 94% (52 students) say that this form of learning is not disadvantaged by them nothing and feel enriched. Personal reflection of students indirectly presents challenges they have overcome. Few of them 27% - (15 students) do not want to repeat more work with information technology, public presentation, unsuccessful results (9. question: What in this academic training you never want to repeat?). The high percentage that supported research technology training course "Primary School Education" - 93% (51 students) (answer to question 15: "Would you recommend such a form of academic and other subjects?") Actually gives reason to comment on the personal difficulties as overcome challenges in skills development for pedagogical adaptability. In summary and evaluation of the management of technology and methods for personal professional development can be quoted student: Yes, because in self-dealing with the tasks lies the opportunity for in-depth insight into the matter, sampling error voltage problem solving, challenge, overcoming, satisfaction ... and all this leads to accumulation of valuable experience and knowledge." (SR)

Third criterion,,Science - research self-reflection“includes seven questions (10., 11., 12., 13., 14., 16., 20). They examine the characteristics of personal self-reflection and research students in indicators:Activeness indicator: evaluative skills for personal reflection, pedagogical competence projection (10, 11, 12. questions).Reflexive indicator: self-assessment as a process of personal growth research; skills for self-reflection and autocorrect activeness in pedagogical perspective. (13,14,16,20. questions).

Figure 5. Activity on activenessindicator-Criterion 3 Figure 6. Reflexive activity indicator - Criterion 3



Criterion 3.Tasks indicator directly coupled to the auto strategy and may be regarded as its initial level of development.Assessment of their appearance make 100% of students - number 55, by answering the question: "Were you able to show that which you are capable of?" (10 questions). In their replies, 65% (36 students) give a positive self-assessment of their self-realization; assessment of 35% (19 students) that have failed to realize the full. This value correlates with reflective index of the first criterion "Technology research teaching" actually is realistic growth by mastering tools for research training. In the same aspect considered and answering the following two questions - 11. and 12. (The results of this training course are they useful for your professional fulfillment, what teaching this course enrich you?). The process of developing a number of research demand personal qualities students are important and necessary for their professional mobility - skills for public speaking, presentation and defense of personal opinions in a professional environment; searching, selecting and analyzing information; skills self-assessment and Auto control. As a summary of those responses here quoted the response of student (BD): "Enrich me that I can work quickly and efficiently in each project, and to understand it."

Reflexive indicator in this criterion expresses the depth of the evaluation reflection. This evaluation only / reflection loaded with value characteristics such as dignity, justice, honesty. This is a own way highest point in the evaluation of academic excellence in teaching and learning technology research, to which reach students. 13. question: This form of training you undermine your personal dignity?, 90% (50 students)

responded negatively, while 10% responded positively. If you trace the development of the answers will be found that are part of that group, which describes the difficulties with handling tools - essay, presentations, etc., Not organized properly in time, has difficulty with basic skills. In the case of a hierarchical building on this issue is being considered for self-assessment and assessment by the teacher: "This form of self-assessment you enter contrary to your expectations?" (question 14) More than half - 74% (40 students) accept, support, understanding and wish to apply in practice similar technology assessment and self-assessment. The remaining 26% do not support this form of assessment. Correlation this group is associated with values in the Activity indicator third criterion "Science - research self-reflection", it emerged that 30% failed to realize the full. And as can be seen from the values in the process of exploratory learning is achieved development, improvement and self-improvement. Correction function of self-assessment can be found in 16. question: "Is it fair to self-assessment projects and have only good reviews?" - 67% (37 students) accept and understand this subjective dependence. They opined that "so correct their own skills assessment and self-assessment" (VT); express their understanding of the formation and evolving assessment: "everyone who has put effort deserves a positive assessment" (BD). They deserve attention and responses that do not support this kind of formative assessment - 32% (18 students) related to the fear of unification "not everyone was excellent." Interesting research analysis is the answer to question 19: "Behind your excellent assessment is there real coverage of knowledge, skills, competencies?". Then come a self-assessment of research and reflections on technology, academic teaching 95% (52 students) of respondents summarize their answers about: "I put effort has already accumulated knowledge, but there is still so much to learn and achieve .... , excellent assessment is a "dream come true" on which work has just begun! "(CP). The last question in reflective index is associated rather with training reflection to future teachers, educators, trainers: Who argument is more value for you - excellent assessment for projects or work for the excellent evaluation of projects?, unanimous answer is "work".

#### **Pedagogical analysis of statistical data**

Research analysis is aimed at developing detection function founding in their criteria and indicators; reveals both cognitive activity and the value attitudes in students, because the process of knowledge is realized through rational thought and affective strategies. (Merdzhanova, Y. 2005). Developing cognitive and affective functions in founding the criteria are directly related to the technological characteristics (technology learning, teaching and self-reflection). Specific in detecting these features is that it happened in the reflections of the students. In this sense it is possible to trace the personal qualities and attitudes, motivation, adaptability, flexibility - qualities necessary for the development of observable pedagogical competences.

The basis of the research analysis is embedded argues that research training is learning through activities and activities. In the research criterion "Technology Research study" to action and reflexive indicators reflect two levels of a technology. Namely, stimulating activity and develop skills related to the research study. According to the results of didactic level operating strategy - a very low proportion of students who have difficulties with the development of projects - 29%. This value refers to the low base (scientific) literacy of students to work with different sources of analysis and evidence - 71%. There is a one but unpleasant fact the product of secondary education and the expectations of higher education. For this serious dividing line speaks recommendation of student written to the teacher: "To give freshmen a chance to get used to its dynamic work because most of them are not faced with this kind of work." (BD) An important fact when considering quality of technology for learning is the organization of the learning environment so that it can be a factor for motivation, support and encouragement. In this sense, correlate the results of questions 3, 4, 5, 6. Actually sent off to the characteristics of the school environment. Significant as a research process and the result is the upward direction of positive responses - 86% to 92%. reciprocally, in descending order of magnitude of 14% up to 8% to reduce the negative reflections on their own capabilities. Presented positive trend upward and downward, downward trend outlines a precise activity-related didactic strategy adapted and targeted to anticipate skills of students. The organization of flexible learning environment that is developing activity-related function to the interest and academic preparation of students emerged as one of the main factors in learning technology research. Self-reflection by the raised level of the Activity indicator in first criterion presupposes the development of the Activity indicator criterion 2. himself activeness indicator "builds" a very clear reflection of the students. In other words: the technology of teaching is premised indirectly from reflexive indicator criterion "Technology of learning."

In the Activity indicator criterion 2 "Technology teaching" are defined two endpoints demarcation of pedagogical reflections. The initial point is the "expectations" and endpoint "experience," or otherwise - learning through experience. Learning through experience is used here as a technique to overcome the prejudices and stereotypes that for the most part, adversely affecting the personality of the student. All students who have had the attitude that pending an "exciting and unusual training" (56%) with those who had no expectations (24%) displayed that by this technique have overcome fear, distance, have developed skills public presentation were stimulated, it has helped to effectively work, have developed the skills to express their own opinion, they are

built confidence, different thinking, self-confidence, security, efficiency and many others this "external" specifics in self expands into deep personal. This level behavioral didactic strategy is implemented for the first time that technique. Professor John Hattie (Hattie, J. 2012), called "visible learning". By carrying out pedagogical research "self-control" students master the elements of holistic assessment - evolving, formative, supportive. Upheaval in supporting high levels of transversal issues related to the research taught is negligible (92% - 94%, respectively 8 and 9 issues). From the standpoint of their own teachers, assessors, students feel "enriched minded and satisfied." These definitions can be considered as reflective indicators of behavioral didactic teaching strategy research.

Taxonomic development of behavioral strategy is found in the third criterion "Research reflection". In empirical results look the pillars of developing an evaluation mechanism: evaluation - self - evaluation - auto control. Auto didactic strategy is implemented 100% because each of those polled students has drawn realistically their own achievements. This can be hard because 35% of students with low self-esteem to self-realization give an "explanation." As outlined in the statistical analysis by correlation values of the two criteria (teaching and learning), low self-realization is directly relevant to the low basic skills that students proceeded academic threshold. Putting his realistic assessment, students estimate that reached / developed some research skills such as search, selecting and analyzing information; skills self-assessment and auto control. Many of them confirmed the conclusion that they are proficient in part by tools such as essay writing, making presentations; working with different sources - books, articles, educational sites, etc., would have a better chance of realization in simulated teaching environment. Level evaluation, understood as a process of forming a quality indicator to reach a certain score high percentage of students understand, accept and seek similar technology evaluation in their own work.

## **VI. Conclusions**

In this pedagogical analysis highlights important trends in research training in an academic environment. Through research tool - a questionnaire of tools for research training, the study was able to distinguish a number of pedagogical nuances and specific features associated with rational structures of modeling with the value reflections, multi-criteria process of scientific literacy and teaching strategies. Highlighted are some basic conclusions to this:

1. Verifies within the boundaries of the study productive technology research learning through positive affective rational and empirical values.
2. Verifies within the boundaries of the study productive technology research oriented teaching through rational construct and adaptable tools (know-how of prof. Georgi Ivanov D.Sc. Ivanov).
3. Outlined the trend of relationship between basic skills developed in secondary education and research learning / skill; this trend should be investigated and lead to qualitative changes in the basic level of future students.
4. Outlined the possibility (through reflection students) research training to continue his development as a future vision of learning in an academic environment (By way academic mastery of the teacher).

### ***Application 1***

*The questionnaire is copyright of prof. George Ivanov, D.Sc.*

#### **Questionnaire**

1. Did you have any expectations for the development of projects in this course?  
A) YES/ B) NOT
2. What you impede the development of projects?
3. Were there any ambiguity in terms of self-assessment and the requirements for clearance of projects?  
A) YES/ B) NOT
4. The requirements for the design of projects you correspond with the character of your academic training?  
A) YES/ B) NOT
5. This form of checking the level of your academic training (through projects) suitable Is?  
A) YES/ B) NOT
6. If you need to decide what form of academic training on this course would you prefer?
7. The form of academic training in this course different is it?  
A) YES/ B) NOT
8. If the form of academic training is different, how you hurt?
9. What this academic training you never want to repeat?
10. Were you able to show that which you are capable of?  
A) YES/ B) NOT
11. Learning outcomes in this course are they useful for your professional realization?  
A) YES/ B) NOT

12. What teaching this course you enrich?
13. This form of training undermine your personal dignity?  
A) YES/ B) NOT
14. This form of self-assessment you enter contrary to your expectations?  
A) YES/ B) NOT
15. Would you recommend such a form of academic and other disciplines?  
A) Yes, because / B) Not, because
16. Is it fair to self-assessment projects and have only good reviews?  
A) Yes, because / B) Not, because
17. You get to evaluate the expression on your project by the teacher, expressed in an unconventional way (use of hyperbole, jokes, banter, transmission in absurd situations, etc.)? Describe your attitude to this kind of evaluation by your personal experiences!
18. If you had to choose any form of verification of your academic training between exam with drawing ticket with questions and exam including an analysis of individual results of the work on the projects which form would you prefer? Argue your choice.
19. Behind your excellent assessment is there real coverage of knowledge, skills, competencies?  
A) Yes, because / B) Not, because
20. Who argument is more value for you - excellent assessment for projects or work for the excellent evaluation of projects?
21. Write at least three recommendations to the teacher on this course!

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