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PH.D. THESIS

Modeling and its use in teaching and learning pedagogical disciplines

SUMMARY

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The summary of the Ph D thesis with the title

"Modeling and its use in teaching and learning pedagogical disciplines"

Keywords:

Didactic Modelling. Teaching. Learning. Pedagogical disciplines. Education. Education theory. Classroom management. Teaching methods. Simulation. Didactic model. The model of a system. The model in mathematics. Active training. Performance standards. School results.

The contemporary society is characterized by an accelerating rate of change. This change requires an adjustment to this rate of life, and the one able to prepare the individuals and the society to deal with changes is EDUCATION.

Education is the subject of pedagogical sciences, but as a complex social phenomenon that is based on the relationship between the individual and the society, it is a concern for the social and Art sciences related to pedagogy.

Education is an essential and permanent function of the society. Thus, education, the greatest "invention" of mankind according to Husley has acquired a very complex character, both through its implications in the sphere of economic, socio-political, cultural life but also by its nature and by its dependence on many social factors for solving it.

Under nowadays circumstances, school has to develop a free, harmonious, creative personality which can adapt to ever-changing conditions of life, which would come to fill the human ideal created by the previous eras.

To have a clear situation regarding the education of the future we need to answer some questions:

1. What do we have today and what ideal are we going to develop?
2. Is the existent ideal at the height of the expectations of the contemporary society?
3. Can the model created by the school be accepted by society?
4. Is current Romanian education prepared for the education of the future?
5. Do current contents cover the needs and the areas of interest of the students?
6. Can the students in Romania face up to the European requirements?

An effective education, prepared for the education of the future is the one that:

-teaches students how to learn. Alvin Tofler said "tomorrow's illiterate will not be the one who can not read, but the one who has not learned how to learn". Attention, critical thinking, creativity, active involvement are the necessary elements for an effective learning.

-forms effective learning skills for students;

-trains them so that they can adapt to modern society based on knowledge

-forms their independent work skills and develops their skills

-puts students in various real situations where they must make correct decisions, solve assigned tasks

-using modern methods that would activate the students-i.d. the principle of active and conscious participation of students in the learning process

-the effective use of the new information and communication technologies

Learning is effective when we notice:

- a positive change in students' behavior
- this change is a result of the personal experience of the student
- the change lasts in time

The work designed as a Ph D thesis entitled "*Modeling and its use in teaching and learning pedagogical disciplines*" analyzes the learning aspects in pedagogical disciplines by using the modeling method in teaching and learning contents. The aim was to determine to what extent its use determines the obtaininf of superior performance.

The work contains two parts: the former part represents the theoretical basis, and the latter the experimental approach, the conducted research done through didactic activities for the discipline "The theory of education and classroom management." Through them and the results obtained, processed and interpreted, we decided to check the established.hypothesis.

The two parts are followed by some *Conclusions* in which we synthesized the information obtained, *Annexes* which represents the instruments used in conducting the research and *Bibliography* - which represents all resources studied in order to obtain relevant information about the researched subject.

The work contains a total of 371 pages, 47 figures, 47 tables, 13 appendices and 195 bibliographic and Webographic resources. The first part – Theoretical basis contains four chapters which develop the issues of the researched subject.

In Chapter 1, entitled "Learning for pedagogical disciplines" we described the pedagogical sciences system providing several classifications recognized nationally and internationally. The man who coined the term of Educational Sciences was Eduard Claparede.

Then,we approached the concept of learning that due to specific projects and other activities took on new meanings. It requires innovative learning, the education of 21st Century must teach the young to know, to do, to be, to work together with the others.

"To train someone in a discipline does not mean making them store results in mind, but teaching them how to participate in the process that makes possible the creation of knowledge", said J.S.Bruner (1970, page 89).

So that teaching and learning should perform successfully it is necessary to use more and more various methods. In describing the methods used in teaching pedagogical subjects both traditional teaching methods and modern teaching methods can be noticed. We're talking about traditional teaching methods and modern teaching methods, but we cannot say that some are effective and others are not, as we cannot deny the virtues of both traditional methods and those of the modern ones. In choosing the appropriate methods for an activity we will consider: the pedagogical objectives pursued, learning contents, the material resources available, time resources, human resources with their particularities, with their own specific experience up to the present moment. Their efficiency depends on their use in the educational activities, the students' training and the results achieved.

Through an investigation conducted at "Regele Ferdinand" High School, we identified some learning difficulties, which, if detected in time, can be, to some extent, alleviated. We also proposed some solutions to correct the problems.

In the second chapter, entitled "Integrating modeling in the system of learning methods" we approached didactic methodology in the context of curricular reform in Romania.The success of an educational activity depends largely on the teaching methodology used.

The curricular reform promotes the transition from classical pedagogy based on the traditional model of transmission, acquisition and restitution to a pedagogy based on the educational model and the personal reflection.

Activation is a requirement of modern education, active and efficient which aims to develop thinking, the motivation for learning, creativity stimulation, the achievement of active and interactive learning and training where the learner should engage effectively, deeply and completely, with all the dimensions of their personality.

L.Gliga and J.Spiro (2001) identify three general criteria of inclusion and classification of active methods:

1) Methods that promote the understanding of concepts and ideas, which capitalize on students' own experience, develop communication and relationship skills, of deliberation on a mental plan and targets an active attitude formation: discussion, role play and brainstorming.

2) Methods that stimulate thinking and creativity, determine the students to seek and develop solutions to problems, make critical reflections and judgments of value, compare and analyze given situations: the heuristics conversation, case studies, problem-solving, modeling, game teaching, exercises and brainstorming.

3) Methods through which pupils are taught to work productively with each other and to develop skills of collaboration and mutual aid: mosaic, the café, the project in small groups and the cube.

The methodology evolves over time in response to the dynamics of the changes taking place in the educational process. C.Cucos identified several trends in the evolution of the teaching methodology:

-the implementation of the new training methods and procedures which should solve adequately the learning situations (the use of brainstorming methods);

- more widely used methods of participatory asset-activation, of students' cognitive and operating structures and by resorting to passive methods only when needed; enjoyment of the method and the "qualitative" aspects of the method;

- expanding the use of methods that require rational components of the teaching activity i.e. the communicational aspect between teacher – students and students - students; strengthening the student's right to learn through participation;

- emphasizing the formative-educational teaching method; expanding the methods of searching and identifying knowledge, and not their own transmission; cultivation of methods of permanent self-education; promoting effective methods that help students in the desired direction; the suitability of the methods to the existing reality (p.288-289).

We found it interesting to list some classifications of the teaching methods. They demonstrate that learning methodology is open to change, accepts novelty, changes according to the current demands of society, adapts to the needs of teachers working with students.

The third chapter named **"Shaping teaching -a method of knowing the reality"** approaches the problem of didactic modelling. Regarding the status of modeling, literature addresses two variants: one that fits modeling into demonstration method and one that considers modeling an independent method. Muşata Bocoş and Miron Ionescu are the followers of the latter option, because, unlike the model-based demonstration, they say, modeling expresses laws almost inaccessible to direct observation.

For modeling to have optimum results, several requirements must be met:

-the model should be an intermediate link between objective reality and theoretical knowledge with the steering in both directions-from the reality perceived as a theory and the other way around-and from theory to the reality which is subject to observation;

-the model should include elements of scientific interest;

- the model should be appropriate to the theme studied;
- the model should reproduce the essential features of the original, to ensure an effective study;
- the model should be used as a tool for discovering new features of the original;
- the model should be a closed system, because it has a certain number of features, and the original
- an open system, because it can always reveal a new feature;
- iconic and ideal models should be combined with demonstration of object models.

In modeling study, the stances in which it can be seen are important.

1. Modeling- the teaching method

The use of modeling in teaching requires active participation of students in activities by analyzing their own patterns, by building new ones, under the competent guidance of the teacher.

2. Modeling- the learning method

Learning through modeling is characterized by the following:

- learning by modeling is based on the model “this material or ideal system that reproduces more or less faithfully the original in order to facilitate the discovery of new properties of this one”. (Ionescu M., Radu I., 2001, pag. 146).
- Model-based learning has a formative and informative value because the student understands better the components, the relationship between objects, events and links established between them.

3. Modeling- a didactic process

The utility of methods and didactic procedures depends on the training situation and the concrete ways to integrate them into the training strategy, their place and their role in achieving the objectives pursued in a given learning activity.

For example, modeling can be a procedure within the demonstration method: demonstration with the help of concrete objects (models). But when the model is seen as a means of research and experimentation, modeling surpasses its demonstration valences, having the role of discovery / rediscovery of some scientific truths and thus, modeling surpasses the status of procedure, becoming a didactic method itself with instructive, educational and formative valences.

4. Modeling- a teaching strategy

To acquire the quality of teaching strategy, a method of education must meet the following criteria (Cristea S., 1998, page 423) :

- active communication, which provides the improvement of the common repertoire regarding the teacher-student correlation;
- heuristic knowledge of the studied subjects that stimulates student's ability of referral, solving and creating problems and problem situations;
- the reactive and proactive creativity of the teacher (and the student) that promotes the full individualization of teaching.

Besides modeling, simulation is also a part of the methods based on practical action and it involves the creation of a model. It facilitates the study and the explanation of complex actions, the observation of the parts and their functioning and also the execution of the operations..

Through simulation, possibilities of execution of actions are created, similar to the real ones. Simulation methods are used when the analytical solving is impossible and the indirect experimentation on the original is non-operational. These include methods of description, modeling and analysis of some real systems or systems in progress. Simulation is always based on the use of a model.

Ioan Cerghit states that modeling "stimulates the spirit of experimentation on a mental plan, the models become the support for intuitive, productive thinking, and its development, cultivates the judgment of analogy, the inventive capacity, hypothesizing, formulation of alternative solutions, the choice of solutions". Ioan Cerghit reminds Leibniz who states that modeling is a strong scientific progress factor, because it is the base of the „simulation” methods, used in technology, in economic anticipation, in the preparation of decisions.

The fourth chapter, named "The Didactic Model", presents the features of the model, the functions of the model, types of models. The term itself seems to have been used for the first time by the mathematician Beltrami in 1868 (The Euclidian model for the non-Euclidian geometry), coming from the latin root, "modus", which, among others, also means "means". Belth considers that the model was the first instrument of scientific knowledge, and Muller considers that the model sends us back to the "prehistory of the science".

C. Barz distinguishes three meanings in using the "model" term:

A. Normative meaning : -the imitated or reproductive behaviour due to its value and meaning;

- a person, fact or object with representative qualities of a whole class;

- an original object for creating similar objects that can be reproduced in an infinite number of copies;

B. Artistic meaning: -person or object for whom the artist will reproduce the image

- two identical shape objects, in different sizes;

- miniaturized or enlarged form.

C. Scientific meaning: -simplified or three-dimensional graphical representation of an idea, process or system;

- a set of elements or variables that make up a symbolic or social system

- logical or mathematical representation of a theory

There are a wide variety of models with a diverse classification.

Mathematical modeling plays an important role in all modeling methods due to the working potential offered by computers with a large memory capacity and high speed work. The mathematical models have emerged from the need to formally describe and study a class of real systems, so that you can control and direct their activity.

Mathematical modeling has been promoted by Cantor and Zermelo who felt that mathematical concepts can be explained through mathematical models. Knowing maths is done by using mathematical models. Mathematical modeling actually involves observing the surrounding world through mathematical problems and solving them using mathematical models.

The second part, **The experimental intervention** includes four chapters in which are described the stages of the experimental intervention and the activities performed within it.

Chapter V, named "**The general coordinates of the pedagogical research**" presents elements of the research organization:

The purpose of the pedagogical research is: to achieve an active and effective teaching process by using the modeling method and the didactic models so that they would improve the learning process at the pedagogical subjects by analyzing, explaining and understanding the terms that are specific to the pedagogical subjects.

The objectives of the pedagogical research:

General objectives:

-Achieving superior performances by using the didactic modeling at the pedagogical lessons;

-The active and conscious involvement of the pupils in the process of gaining new knowledge;

-The realization of a deep learning process at the pedagogical subjects.

Specific objectives:

O 1. Designing classes that would propose to the pupils certain learning situations based on modeling, thus making it easier for them to get used to arguments through analogy.

O 2. Using these lesson systems and applying the research instruments that we created- questionnaires and tests.

O 3. Improving the teaching quality and stimulating a creative educational system by using the modeling method at the pedagogical subjects.

O 4. Creating certain mnemonic and technical capacities in pupils by using the modeling method.

O 5. Registering, monitoring and comparing the results achieved by the students that make part of the experimental and control classes at different stages of the research(the pre-experimental stage, the formation stage, the post-experimental stage, the re-testing stage).

The hypothesis that started the idea of the research was formulated this way:

Using the modeling method determines significant improvement in terms of pupil performances at pedagogical subjects, producing an active learning process.

The dependent and independent variables used in this research are the following:

a) The independent variable - the continuous use of the modeling method while teaching and learning the contents of the following pedagogical subjects: the education theory and classroom management.

b) The dependent variables - the ones that depend on the independent variable and the ones that change like it does are the pupils' performances (noticeable at the level of conscious, active, logical and rapid understanding and assimilation of contents at the pedagogical subjects).

Our research was made for the following subject: "The educational theory and classroom management", the 10th grade, pedagogical profile, specialization - Instructors for extracurricular activities. There were 150 teachers and 240 pupils involved in it, as it follows:

A. The human resources that participated in:

a) The finding stage:

- 150 teachers from different schools:

*23 teachers from the preschool educational system, Sighetu Marmatiiei

*27 teachers from the elementary educational system, Sighetu Marmatiiei

*19 psychology-pedagogy teachers from different schools around the country

*81 teachers of various specialties, Sighetu Marmatiiei;

- 240 pupils:

*93 pupils from "Regele Ferdinand" Highschool, Sighetu Marmatiiei

*88 pupils from "Taras Şevcenko" Highschool, Sighetu Marmatiiei

*59 pupils from "Andrei Şaguna" National College, Sibiu

b) The formative experiment stage:

-3 teachers that are teaching the classes that are participating in the pedagogical experiment

-30 pupils from "Regele Ferdinand" Highschool, Sighetu Marmatiiei

-59 pupils from "Taras Şevcenko" Highschool, Sighetu Marmatiiei

-27 pupils from "Andrei Şaguna" National College, Sibiu

The research methods that we used are:

- * the systematical observation
- * the investigation based on a questionnaire
- * the psychopedagogical experiment
- *the method of the research of the curricular and other school documents
- *the individual and collective talk
- the testing method

For the research we have chosen the parallel sample technique, its stages being:

1. The preexperimental stage
2. The formative experiment stage
3. The postexperimental stage
4. The retesting stage

In chapter VI, named the **Finding stage**, is described the preexperimental stage whose purposes are the following:

O 1. Finding out the teachers' opinion about the modelation method as a didactic method, didactic process and didactic strategy.

O 2. Analyzing and describing the way the teachers create didactic models.

O 3. Finding out the pupils' opinion about the place and the role of the psychopedagogical subjects in the educational system plan.

O 4. Creating the content sample through choosing the educational units that will create the research object.

O 5. Finding out the pupils' level of knowledge in the domain of science of the education.

O 6. Finding out the difficulties that pupils encounter while trying to accumulate new knowledge.

O 7. Identifying the methods and the strategies that help them overcome the difficulties.

O 8. Creating the pupils' samples by choosing the experimental and control classes.

O 9. Creating the pairs of equivalent classes- experimental and control - that have about the same capacities regarding the preparation level at the pedagogical subjects, but also regarding the social and cultural environment they're coming from.

In the finding stage a questionnaire has been applied to a sample made up of 150 teachers: 50 teachers for the preschool and elementary classes from Sighetu Marmăției, having different teaching years., 81 teachers with different teaching years and different specializations from more schools from Sighetu Marmăției and 19 psychology- pedagogy teachers from different highschools in the country.

The purpose was finding out the teachers' opinion about using the didactic modelation in the instructive-educational activity.

From all the 150 teachers questioned, only 4 of them haven't accepted that modelation can be a teaching method. Regarding the use of different types of models and their frequency, we noticed the following:

* The figurative models are the most frequently used by the teachers questioned, 126 teachers, meaning 84% of them;

*The explanational models are used by 110 teachers, meaning 73% of them.

* The material models are used by 98 teachers, meaning 65% of them.

* On the last place regarding the frequency of the use of didactic models by the teachers questioned are the symbolic models.

The experiment itself was preceded by the study of pupils' opinion about the psychological and pedagogical subjects, the pedagogical practice and the vocational profile - their importance and role in achieving the teacher job.

Regarding the questionnaire given to the pupils, the answers were varied. In choosing the vocational profile, from 240 pupils, 178 admitted that their parents influenced them the most in choosing this profile. Most of them want to follow this profile for its beauty, which implies working with children, the possibility to do more pedagogical practice and the active and constant involvement in the instructive-educational process of the little ones.

By a very small difference, 1% to the first one, the second option of the pupils when choosing this vocational profile is the reason that it is very prestigious, the pedagogical highschool being a valuable highschool that gives you the possibility to become a teacher in the preschool educational system and the elementary educational system.

All the pupils know that the preparation for this profession includes pedagogy. All the pupils questioned are studying this subject and they are aware of its importance and role in the process of becoming a teacher.

Chapter VII, "Experimental investigation on the use of modeling in science education" shows the operations performed in the experimental classes. Classes chosen for the experiment are the following:

- a) The experimental sample consisted of:
 - 30 students, class 10th A, "Regele Ferdinand" High School " – Sighetu Marmatiei
 - 22 students, class 10th C, "Taras Sevchenko" High School " – Sighetu Marmatiei
- b) The control sample consisted of :
 - 27 students, class 10th A, "Andrei Saguna" National Teacher Training College – Sibiu
 - 27 students, class 10th C, "Taras Sevchenko" High School – Sighetu Marmatiei.

The learning units chosen for the experiment are:

1. Sides of education

- Religious education
- Physical education
- Technological education
- Intercultural education
- Health education
- Environmental education
- Entrepreneurial education

2. Theory and methodology of civic education. The human being and the social life.

- The human being and the social context. The socialization process.
- Social groups
- Characteristics, typology, interpersonal social relationships.
- Community
- People
- Nation
- International community.

3. Political and social system. Political social institutions. Democratic institutions and practices in Romania.

- State organization of society
- Political regime
- Public authority
- Civil society, NGOs, the media in public life.
- Civic participation

4. Citizen-state report.

- Fundamental values of democracy
- Education for democratic citizenship.
- Human rights.
- Citizens' rights and duties.
- European integration.
- European citizenship.

We present below the experimental didactic system, samples of subjects and content contained in the experiment.

Learning unit	No. of classes	Experimental Classes	Control Classes	Total no. of classes participating in the research	Total no. of students participating in the research
Sides of education	14	E1. 30 students	C1 – 27 students	4	106
Theory and methodology of civic education The human being and the social life	14	E2. 22 students	C2 – 27 students		
Political and social system. Social and political institutions, democratic institutions and practices in Romania	12				
State citizen report	14				

In this chapter we have included the post-testing part which involves testing the students at the end of the experiment and re-testing which involves testing the students in the long run – remote checking .

Chapter VIII, entitled “**Presenting the obtained results**” highlights the evolution and school performances recorded by samples of subjects during the pedagogical investigation. Interpretation of the results was achieved through several analyses:

1. Intergroup qualitative comparative analyses, made between experimental and control groups.
2. Intergroup qualitative and quantitative comparative analyses, made by pairs of classes En – Cn (where n=1,2)
3. Intergroup qualitative comparative analyses, for the experimental group, comparing it with its average initial test, according to which there are three types of subjects: with very good results, with average results and with bad results.
4. Qualitative and quantitative comparative analyses for the experimental group.
5. Qualitative and quantitative comparative analyses for the control group.
6. Estimated statistics analyses of values from post-testing and retesting.

The analysis of the results obtained by students confirms an evolution of experimental samples. School performance achieved by experimental samples is due to the introduction of the modelation method as a basic method in teaching and learning for pedagogical disciplines. Analyzing the results we can say that they confirm the proposed hypothesis.

Using didactic modelation in all lessons performed in the formative experiment was a challenge because it involved diversity, creativity, efficiency in solving multiple tasks, analytical, critical, creative thinking, intrinsic motivation, a good coordination, mentoring and organizing of activities, optimum collaboration between the teachers involved in the undertaken pedagogical experiment.

The value of the experiment is undeniable. Statistical results obtained as a result of processing the data confirm our research hypothesis: the use of the modelation method leads to significant improvements regarding students' performance in pedagogical disciplines, producing an active learning.

The use of the modelation method in teaching and learning for pedagogical disciplines has a major impact on educational practice and proved to be a way an effective way of acquiring knowledge. This research aims to bring value by highlighting real valences of the didactic modelation method used in pedagogical disciplines by providing more examples of activities at pedagogy which is based on the modelation method.

This work also harnesses didactic modelation in different stages of the lesson thus supporting the educational process in pedagogical disciplines.

Another aspect that highlights the value of the experiment is the cognitive acquisitions. In the formative experiment, by using the didactic modelation method, students had the opportunity to practice their ability to express their ideas, by studying and analyzing didactic models, accompanied by clear arguments, practising critical and creative thinking strategies.

It is also worth mentioning the fact that before the formative intervention students were asked to answer or solve more tasks given by the teacher, later during the pedagogical experiment we can notice a participation and active engagement of students in the activity and this is due to the use of the modelation method.

The didactic modelation is the basic method used successfully in the activities within the experiment, its effectiveness being proven by academic performances of students. The contents to be learned were presented in a form that challenges the student consciously and actively from the intellectual point of view. So students were able to better understand the contents and apply them in practice. Engaging in the activity, students formed the ability to express opinions and assessment over processes and phenomena studied.

Students' thinking is centered on the analysis of possible solutions in a given situation, having to choose the optimal response accompanied by arguments. The working atmosphere was favorable for learning. A positive climate in the classroom was provided, students received correct explanations, complex and clear in terms of learning contents, but also on the tasks; teachers also ensured that they were properly understood by students. In the didactic activities

completed, students had contact with real life situations and practical problems of life thus facilitating the participation of students in solving practical problems of life.

But together with didactic modelation, other methods were also used, interactive didactic methods that have improved the formative potential of the didactic modelation. Didactic activities involve joint effort of the teacher and the students and lead to the discovery of new knowledge. Achieving pedagogical objectives proposed for each activity was made possible by the organization and development of some effective didactic activities.

This work, conceived as a Ph D thesis and entitled “Modelation and its use in teaching and learning pedagogical disciplines” contains 371 pages, a total of 47 tables and 47 figures, and a bibliographical list of 183 titles and a webography of 12 addresses, and has a total of 13 annexes.