

THE ROLE OF THE "GEOSPACE" FORMATION PROGRAM IN DEVELOPING GEOGRAPHY TEACHERS' COMPETENCE, IN RAISING THE DEGREE OF LESSON ATTRACTIVENESS AND IN IMPROVING STUDENTS' RESULTS

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ABSTRACT

This paper starts from the analysis of needs of specialty training for Geography teachers when confronted with the scientific evolution of the field and considering the challenges imposed by an ever changing educational system. Within this framework, the Faculty of Geography at "Babeş-Bolyai" University, Cluj-Napoca, Romania, as a supplier of teacher training courses, organized a training course in the field of Geomatics. We analyzed the necessity and usefulness of this type of training course considering the number of teachers interested in this training course and an evaluation form of the course. Additionally, we evaluated the way in which the competences obtained during the formation program in Geomatics were put into practice on two separate components: an increase in the degree of

attractiveness in Geography lessons and the improvement of students' school performance. The efficiency of the training program was evaluated by comparing the knowledge taught during a reference lesson in which the teaching was carried out in two different ways. The following step was to apply a unique test to two different student groups with a similar level of knowledge, which revealed that the best results belonged to the students in the group in which the methods and techniques used to deliver the teaching were the ones acquired during the training course. By validating the initial hypothesis, we reached the conclusion that it was necessary to introduce these GIS-TIC contents in the educational context for pre-university education.

Keywords: *Geomatics, school performance, computer aided instruction, educational software, student-centred methods*

INTRODUCTION

A context analysis allows us to assert that Geography in Romanian schools reflected to a small extent the spectacular paradigm changes that occurred in the geographical field (Petrea, 2005). Students were being taught an obsolete school subject both as contents and applicability in which descriptivism prevailed most unproductively together with a propensity for encyclopaedic information, empirical knowledge, singular occurrences, etc. (De Vecchis, Pasquinelli D'Allegra, Pesaresi, 2011).

Additionally, it became evident that school textbooks relied heavily on information that was not essential, rather difficult to generalize, often obsolete or prone to becoming obsolete. Moreover, the modern preoccupations of Geography as a scientific field were almost unnoticeable whereas the techniques and instruments that revolutionized the practical side of the domain (such as tele-detection, G.I.S analysis) were almost inexistent in school textbooks.

Starting from these two generalizing assertions, which emerged from a careful observation and analysis of the Romanian education system as far as Geography was concerned, we were able to identify a series of deficiencies, which could be grouped in three distinct categories:

- structural deficiencies, pertaining to the fragmentation of educational content into disciplines and the absence of an inter-disciplinary approach;
- scientific deficiencies, pertaining to the contents and their obsolete nature;
- strategic or methodological deficiencies pertaining to the outdated teaching methods which were teacher-oriented and obsolete teaching materials and teaching aids;

All these deficiencies could be traced back to at least three causes:

- the considerable gap of the past two decades between the geographical science promoted in academic environments and Geography as a school subject in the pre-university educational system;
- the large percentage of teachers who (for some objective reasons, pertaining to the recent evolution of the domain) did not possess the necessary knowledge and competence to use modern instruments (Information and Communication Technology – ICT, tele-detection) in teaching Geography in schools and who demonstrated a low level of Geography knowledge and competence when approaching Geography contents with students during classes;
- the obsolete nature of applying techniques and instruments currently promoted by the Didactics of Geography during classes, some of these means proving to be inappropriate for promoting the practical applicability which consolidated contemporary Geography, particularly deriving from the acknowledgement of its usefulness in solving a wide range of social and economical problems.

As a natural necessity of this critical analysis, we developed a training program with the purpose of supplying teachers with new information and state-of-the-art instruments, which were necessary in the attempt to tackle the deficiencies that were currently noticeable in the teaching of Geography in the pre-university educational system in Romania.

The goal of this paper was to analyze this training program and to evaluate its efficiency starting from a number of hypotheses mapped onto a system structured on three validation levels.

PRESENTATION OF THE TRAINING PROGRAM: INTRODUCTORY ASPECTS

The teacher training activity is essential in the professional development of a Geography teacher. Not only the beginner teacher, but also the experienced Geography teacher needs continuous training in order to keep in touch with the new scientific elements that emerge in this dynamic field. The common and desired course of action regarding the training of any Romanian teacher presupposes obtaining the so-called didactic degrees (the Definitive Degree, the Second Degree, and the First Degree) and that of continuous training, which enforces a specialized training by means of the selected methodology within a period imposed by current legislation.

Another form of training consists of the individual training activity visible in the drawing up of scientific papers, studies in the field of the

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Didactics of Geography together with participation in scientific conferences and in methodological meetings of Geography teachers.

Nonetheless, as in the case of initial formation, we strongly believe that the most effective form of training consists of establishing contact with academic circles, which is in fact referential in supplying scientific novelty and innovation in any field of specialization.

Taking into consideration the training needs of Geography teachers in the pre-university education system the Faculty of Geography at the "Babeș-Bolyai" University in Cluj-Napoca set up the Geomatics Centre in 2011, intended to provide additional training to Geography teachers in the pre-university education system (GEOSPACE). The centre was established as part of a project financed by the European Social Fund through the Operational Sectorial Program for the Development of Human Resources (2007-2013), POSDRU contract no. /87/1.3/S/57378

The general objective of the project was to create a structural approach and provide implementation of a complementary training program that would allow the teachers of Geography in the pre-university system of education to acquire and develop their competences in the field of Geomatics by means of a set of innovative training modules that facilitated the acquisition of the latest techniques and instruments with unquestionable advantages in teaching sciences about the Earth.

One of the hypotheses was that participation in the training program would generate positive effects in the direction of the improvement of the teaching staff in what concerned interactive teaching methods with the help of software instruments and also in what concerned the acquisition of key competences and professional knowledge by the students necessary for their involvement in research activities in fields connected to Geography, such as Earth Observation and collecting data from satellites imagery.

The Geo-space Geomatics Centre project was conceived for additional training of teachers in the pre-university education in the field of Geography and was aimed particularly at the teachers in the North-West and Centre Development Regions in Romania and the target group was made up of approximately 1,200 Geography teachers working in the schools of the 12 counties belonging to this territory (Maramureș, Satu-Mare, Sălaj, Bihor, Cluj, Bistrița-Năsăud, Mureș, Harghita, Covasna, Brașov, Sibiu, and Alba).

The unfolding of the program relied both on the logistic support (specialists and infrastructure) owned and made available by the Faculty of Geography at "Babeș-Bolyai" University in Cluj-Napoca (the beneficiary) as well as on the partner S.C. Advanced Studies and Research Centre in Bucharest.

METHOD

Participants

During the unfolding of this program, 720 Geography teachers attended the courses and they were selected based on criteria of territorial proportionality, scientific and didactic performance, rural-urban ratio, male-female ratio, according to EU requirements.

In Figure 1, we presented the distribution in participating counties. Apart from the geographical distribution of participants, which demonstrated the attendance of all 12 counties of the two development regions in target, we wished to underline that 33% of the participants had already obtained a Master's Degree in the field of specialty and 4% of the trainees owned a PhD in Geography.

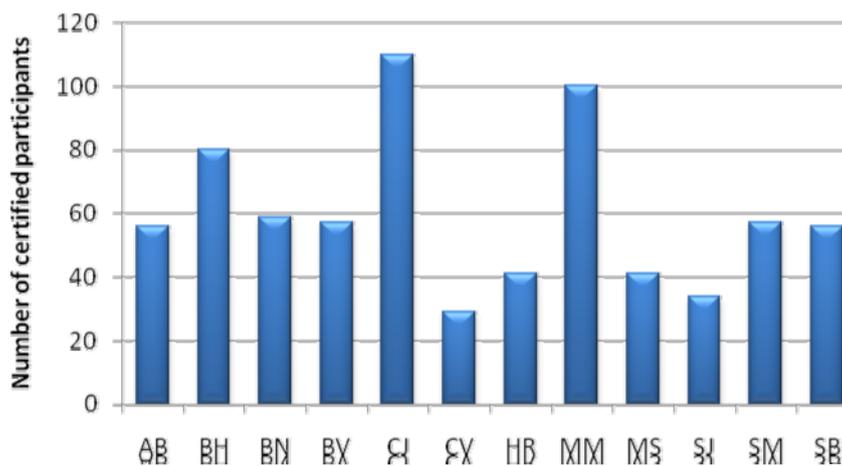


Fig. 1. Distribution of participants on counties

Structure of the training program

The actual duration of the training program was 60 hours, distributed over five consecutive weekends (6 hours every Saturday, 6 hours every Sunday). The training activities were organized on groups of 15 trainees in classes, which were endowed with computers, multimedia, and Internet access. During their participation in the training program, the trainees were offered lunch and those who were from other counties were offered free accommodation.

The modules of the curriculum plan and the topics were set up in correlation with the teachers' needs, with the goal and objectives of the program, without omitting the optimal distribution of theoretical issues,

practical applications and of standardized evaluation instruments. Four main modules were established; these included a variable number of topics beside which we added the evaluation time. The ratio between theoretical approaches and practical applications is 1 to 2, in full accordance with the main goal of the project: the formation and development of Geography teachers' competences in using ICT, using methods and techniques that were specific to Geomatics.

Table 1. The curriculum plan and topics of the training program

Module	No. of credits	Topic	No. of hours		Evaluation form
			Theory	Practical applications (tutorial)	
1. An introduction into Geomatics	3	An overview of tele-detection and GIS analysis	4	8	
		Types of resources, imagery, data accessibility			
		Visualization programs: Google Earth/Maps, Open street map, etc.			
		Information sources (The European Space Agency, Eduspace, etc.)			
2. Presentation of the main interactive instruments	3	An introduction into the main interactive instruments in teaching Geography	2	4	
Mid-term evaluation (Ev. 1)		Evaluation of knowledge obtained during Modules 1 and 2	1/2	1/2	Practical trial
3. Use of interactive instruments in teaching Geography	3	Analysis of seaside processes on satellite imagery. Study cases from the European and Romanian space.	1	3	
		Applications of METEOSAT images in atmosphere dynamics and weather forecast.	1	3	
		Analysis techniques of terrain usage. Corine Land Cover	1	2	
		Main relief forms in Romania. Analyses based on altitude numerical models and satellite imagery.	1	2	

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		Understanding geo-morphological, hydrological and weather-marine risk with the help of satellite imagery.	1	2	
		Mid-term evaluation (Ev. 2) Evaluation of knowledge obtained during Module 3	1/2	1/2	Practical trial
		The evolution of settlements based on cartographic tools and satellite imagery.	1	2	
		Modifications of geographical landscapes because of human intervention. The meltdown of the Antarctic ice field.	1	2	
		Specific elements of the physical-geographical European space. Case studies: the Alps, the Mediterranean Sea, the Black Sea, the Danube.	1	2	
		Specific elements of other extra-European spaces. Case studies: Asian, African, American and Australian spaces	1	2	
		Mid-term evaluation (Ev. 3) Evaluation of knowledge obtained in Module 3	1/2	1/2	Practical trial
4. Making tutorials		Making tutorials	1	5	
Final Evaluation (Ev. 4)	6	Final Evaluation (final grade = 50% partial evaluation + 50% presentation of tutorials)		3	Presentation of tutorials

Because of participating in the training program, each participant obtained a certificate issued by CNFPIP (The National Centre for the Training of Teaching Personnel in Pre-university Education) and the 15 credit points assigned by the program. An additional attractive element was that every trainee was granted the opportunity to participate in a project contest with the prospect of earning a 3,000 RON prize.

In order to make a final verification of the hypothesis, we introduced a level III of validation by following up with teachers to observe the manner in which the competences acquired by geography teachers during the Geomatics training program were being transferred to their students. The

transfer to their students, in point of efficiency, usefulness and applicability within the lesson, could be verified in two ways:

- increasing lesson attractiveness, getting students attention and training students by using digital means and multimedia;
- improving students' learning results.

Table 2. The correlation between the hypotheses of the study and validation levels

Hypotheses	Validation
Necessity and usefulness of the training program	Trainee numbers Evaluation form
Increasing the degree of lesson attractiveness	General appreciation
Improving students' results	Results of the comparative test

In order to verify the hypothesis, we selected the lesson entitled "Genetic Relief Types in Romania and Europe" from the 12th grade school syllabus, which was taught in two different manners at two classes with similar performance levels.

For class XII B, the lesson was organized in the classical manner by resorting to the interpretation of geographical images, geographical drawings in the textbook, working with the map in an atlas, brainstorming, explanations, making comparisons, etc.

For class XII D, the lesson resorted to the following educational means: interactive board, Geografika of Romania software (interactive maps), applications from the Interactive Lessons 1 software (for instance simulation of delta, lagoon, river-maritime firth formation), QGIS tutorials for delta evolution, Google Earth for the visualization and positioning of relief types.

Evaluation instruments

In specialized literature, evaluation is defined as "[...] all the activities that include the organization, the collecting and the treatment of data by applying measure instruments to give valuable thoughts which are the basis of a certain educational decision" (Dulamă, Roșcovanu, 2007).

In any evaluation system, the methods and means for carrying out evaluation have an important role (Nicula *et al.*, 2012). Therefore, the identification of evaluation means that are in accordance to the starting hypotheses has represented a major concern in carrying out this research.

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The evaluation instrument applied to the teachers after the training course

For the level 2 hypotheses validation, we conceived a course evaluation form by means of which to collect feedback from the trainees, useful as both an instrument for regulating potential deficiencies occurring during the training program and as an instrument of final evaluation of participants' satisfaction.

The evaluation instrument (Annex 1) was conceived to allow the evaluation of course unfolding, organization, contents, efficiency, usefulness, and teaching style.

The evaluation instrument applied to students after being involved in the experimental learning activity

We conceived and applied a test for the evaluation of knowledge obtained from the taught lesson in both classes. The test was structured on three parts.

Part I comprised eight objective items (multiple choice) aiming at competence (7.1) – Application of knowledge and skills acquired, for example:

"The dry land areas in the Danube Delta are called:

a. eyeholes b. mounds c. elevations d. braces

At the effusion of the Seine River, there is formation of:

a. delta shore b. estuary shore c. lagoon shore and river-maritime firths d. fjord shores"

The second consisted of two subjective items concerning competence (7.8) – Explaining the relationship between groups of elements, processes and phenomena occurring in the geographical field.

"Explain the causes of the Danube Delta withdrawal:

Explain the difference between a lagoon and a river-maritime firth"

Part three consisted of 6 objective items (with paired response), concerning competence (1.1.) – Using scientific terminology and specific field terminology for the presentation of pertinent information, for instance:

"Associate types of relief in column A with corresponding terms in column B:

A	B
<i>sink hole</i>	<i>rift valley</i>
<i>river-maritime relief</i>	<i>symmetrical valleys</i>
<i>plicate relief</i>	<i>escarpment</i>
<i>fissure relief</i>	<i>estuary</i>
<i>tabular relief</i>	<i>circular precipice</i>
<i>monocline relief</i>	<i>anticline ridge</i> "

RESULTS AND CONCLUSIONS

a. Level 1 of hypotheses validation was represented by the program's success, with all the 720 available places being occupied within the time framework, which denotes the necessity and usefulness of the program for teachers.

We believe that this level of validation in point of usefulness and efficiency is prone to lack of objectivity for at least 2 reasons: first, the trainees were not aware of the course syllabus and teaching methods in detail, their enlistment to the course being entirely based on a brief presentation partly delivered by the notoriety of the training supplier (the Faculty of Geography – Babeș-Bolyai University Cluj-Napoca); secondly, the program provided some financial advantages (financial support for accommodation and meal expenses and substantial grants for the participants), which, to some extent, might have effaced the fundamental motivation, that of professional training and development. Thus, we believe that the mere number of participants is not sufficient to determine the usefulness and efficiency of the program. Additional elements were needed in the attempt to validate the hypotheses.

b. From the analysis of the 720 evaluation forms filled in by the trainees, the closed items have led us to conclude that there was a high and very high degree of satisfaction in relation to the contents of the course (over 95% of the participants have assigned "good" and "very good" to the character and usefulness of the course. Also, the elements of the evaluation form captured "in free" format as weaknesses, strengths and suggestions, support the conclusions drawn based on the analysis of the first part of the evaluation form.

The results of the tests applied to students

In class XII B, from a number of 30 students taking the test, an average grade of 6.37 resulted, whereas in class a XII D, from a number of 32 students tested, an average grade of 8.15 resulted. The difference between the average grades is 1.78 points, which we believe to be beyond the error margin resulting from the slightly different level of knowledge between the two student groups or other conjuncture factors.

For further validation, we could make a comparative interpretation on other key items or we could extend the research to more lesson types or student groups.

From the compared test results, it is safe to assume that the hypothesis according to which students obtain better learning results from participating in lessons in which these methods are used is validated, sustained by the observation that these lessons are much more attractive and engaging for students. Based on that, we believe the following recommendations are necessary:

- using interactive maps from the geography educational software in as many lessons as possible;
- using satellite imagery from Google Earth;
- making maps with students on various thematic layers with the help of GIS open source software (QGIS);
- using interactive boards;
- using differential worksheets on interactive boards, which students can solve digitally on the board.

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Annex 1

COURSE EVALUATION FORM

Name and Surname of Participant _____

The current evaluation form requests your opinion regarding the unfolding of the course in which you have taken part.

For each statement assign a score from 1 to 5, where 1 stands for "I totally disagree with this statement" and 5 stands for "I totally agree with this statement".

Objective answers are of real use to us in attempting to improve the quality of the course and will not influence your results in any way.

Upon completion, please assign an X to the desired score box

No.		1	2	3	4	5
1	<i>The content of the course was well structured and contained relevant information.</i>					
2	<i>The key notions were sufficiently extended.</i>					
3	<i>The information was relevant in relation to the course topic.</i>					
4	<i>The course was sufficiently adapted to your needs.</i>					
5	<i>The course unfolded in an interactive manner.</i>					
6	<i>Practical applications were designed to highlight particular aspects and clarify them.</i>					
7	<i>Practical notions were correlated with the theoretical presentation.</i>					
8	<i>The time line assigned for each module was used efficiently.</i>					
9	<i>Means of conveying information were used (PowerPoint presentations, exercises).</i>					
10	<i>The information comprised in the course textbook was detailed</i>					
11	<i>The subject matter was up to date and was well documented</i>					
12	<i>The course textbook was useful and well structured.</i>					
13	<i>The trainer had an interesting and stimulating teaching style</i>					
14	<i>The trainer answered all the course related questions asked by participants.</i>					
15	<i>The trainer manifested availability for discussions even beyond the course time line.</i>					
16	<i>The trainer facilitated discussions during the course.</i>					
17	<i>The trainer successfully employed the participants' previous knowledge.</i>					
18	<i>The trainer demonstrated efficiency in teaching the subject matter.</i>					
19	<i>The trainer expressed ideas clearly and on the topic.</i>					
20	<i>The trainer presented clarifying explanations when necessary.</i>					

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21	<i>The trainer encouraged participants to express freely.</i>					
22	<i>The trainer expressed availability in providing additional information to participants.</i>					
23	<i>The trainer demonstrated competence in the domain of the topics to be taught.</i>					
24	<i>The trainer involved all participants in the activities.</i>					
25	<i>The course was well organized.</i>					

1. What were the strong points of the course (i.e. what were the aspects, which helped you the most in learning what was being taught?)

2. What were the weak points of the course (i.e. what were the aspects, which created difficulties in understanding what was being taught?)

3. What are your suggestions for improving the course?

Thank you for your participation and for your time!

Signature _____