Concepts Map Approach in e-Classroom

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This article is designed as an educational research study focused on e-Classroom as a medium of instruction based on assisted didactics design and teacher assisted learning in order to develop interactive applications, integrating concepts map approach. In this context, the paper proposes a specific conceptual framework applied in a theoretical model, as a base of an analytical framework used in a case study. Such a paradigm defines the classwork as the basic activity of the student which connects the fieldwork and the deskwork, and finally, it develops the basic and specific competencies of the individual according with the educational objectives.
Keywords: *Assisted Didactics Design, Classwork, Threshold Concepts, Troublesome Knowledge, Teacher Assisted Learning*

1 Introduction

Education could be considered the engine of our society because of the main responsibility of this domain regarding knowledge conversion. E-Education reconsiders the whole society and focuses on how to transfer the knowledge, and more important, how to develop the content for a continuum update policy. Such an approach explains e-Education as an information system based on assisted didactics design; in this context, computer assisted instruction could represent an educational application of the information system, and assisted instruction is developed as a social application of the whole environment. A functional difference between Education and e-Education could be highlighted by the statements “lifelong learning” and “lifelong learners”. E-Education introduces a new vision between academic disciplines; multidisciplinary approach is by default, the first type, as it was implemented on the first version of the e-learning software platforms. Next step on this way it could be interdisciplinary approach, which engages two or more disciplines in order to create and apply new knowledge, as soon as they work together. E-Education promotes a new vision too, about the learners, because, by default, computer assisted instruction implements individualized learning. The second level of this direction is to develop interactive applications designed for personalized learning.

Technological infrastructure is a dynamic system which generates new borders for knowledge domain, for the whole society, revealing the e-society; e-education, the engine of the e-society, implies more complex activities, and, in this context, a key activity is represented by the scientific research in e-education, correlated with a new functionality designed to turn the theory into practice. As soon as knowledge developed by scientific research in e-Education is recorded in technology, from a social perspective, the difficulties lies precisely to teach the knowledge workers in order to understand and apply available technology, and as a key of this demand, to train the trainers in a dynamic technological infrastructure [15]. As a result of this paradigm, the traditional Classroom, existing in education, could be completed and developed as an e-Class, supported by e-learning, or as an e-Classroom, mediated by teacher assisted learning, see Fig. 1.

This overview of the main features of the e-education determines twofold purposes of the further analyze: enhancing a concepts map approach in the educational research and reviewing the assisted instruction discipline as an appropriate human activity in information systems for an educational purpose.

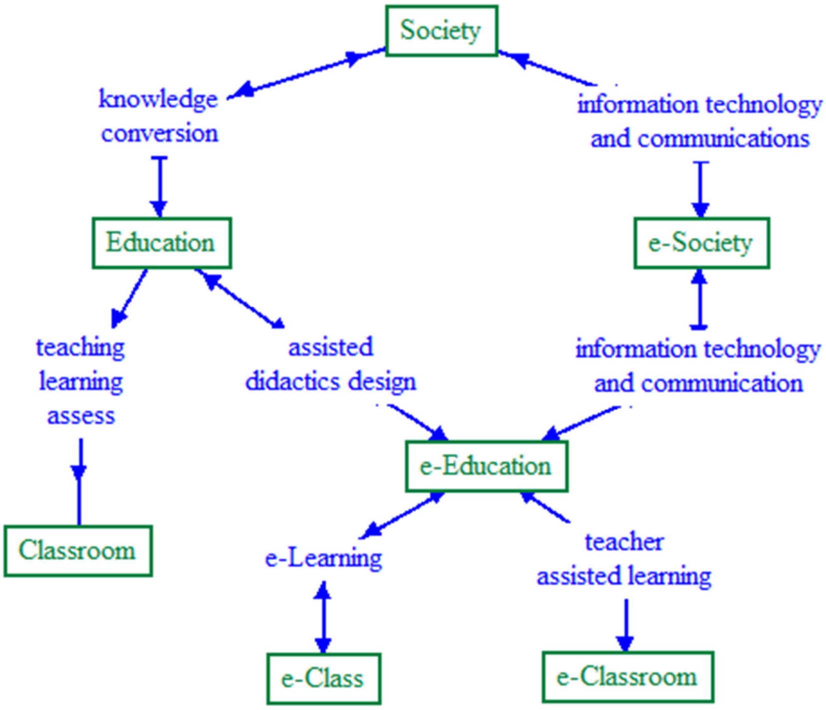

Fig. 1. An educational paradigm for our society

2 Conceptual Framework

Concepts are always on the front-burner of the theoretical scientific research within terminology, as long as they belong to the scientific field of the research disciplines. Terminology focuses on specialized or specific subject areas within which it studies knowledge (units [e.g. concepts], structure, representation, evolution, acquisition, use, etc.) in its relation to expression. The study of concepts is well-developed within terminology because terminology approaches knowledge from the standpoint of conceptual logic, as opposite to propositional logic. Concepts (to which labels – linguistic or non-linguistic would normally be assigned) are the building blocks of knowledge [1, pg. 5-14].

Developing another approach, [9] highlights that "one of the challenges in mastering *Knowledge Management* is to understand the terminology of the field. In any field one must have a common understanding of the nomenclature of both the terms and concepts. People use the same words and phrases but the meanings could be different based on gender, location, context, profession, etc."

[6] reflects that knowledge can be defined as information about what has been perceived, discovered or learned regarding objects in the world around us. Such objects may be concrete or abstract; they may denote relationships, functions, or activities. Through intellectual processes such as abstraction and conceptualization, objects are categorized into classes or models called concepts, distinguishable from one another by sets of characteristics. In terminology research, concepts are named or designated by terms, and identified by sets of characteristics, called semantic features.

[11] starts from the idea that knowledge of any research field is mainly gained through reading published research documents. As a matter of fact, inconsistent terminology has a negative impact on effective communication, making sense of research findings, integrating studies, and building cumulative theory. Terminology inconsistency may be a significant impediment to effective communication and to our competence to make sense of research findings. Inconsistencies with the use of terminology have been highlighted by research in many fields, such as Computer-Supported Cooperative Work (CSCW), marketing,

electronic negotiation, health, and education.
[2] considers "self-evident that every scientific activity is based upon principles which are, ultimately, the elements that allow us to assess the coherence of a particular position or reasoning". In this context, the author highlights the premises to study terminology under two headings: the first asserting general principles, and the second focusing on the diversity of application. The first principle statements terminology as an interdisciplinary subject constituted of fundamentals from linguistics, cognitive science and social science. Due to this three-fold interdisciplinarity, terminological applications are also tridimensional. The interdisciplinary character of a subject field allows elements from other disciplines integrating the premises and restructuring them. Any interdisciplinary field, as soon as it is an integrated unit, can be analyzed by focusing on one of the angles of its multidisciplinarity. The fifth principle statues that terminology is multifunctional, which allows it to set itself several goals and enables it to update its polyhedral nature. The best known application of the theory of terminology is the collection of terms and the compilation of the specialized dictionaries. At the same time, "any terminological activity is socially justified by its usefulness for solving problems of information and communication".
According to an educational approach, [3] presumes that students learning science need to associate theoretical descriptions and explanations of how things in the universe work with common sense, or knowledge derived from everyday experience. This work analyses terminology theory and metaphor theory which are mutually enriching. "Metaphor theory uses the concept of assumptive frameworks, as well as source and target fields to clarify how metaphors function. Terminology theory describes conceptual space, and defines terms in a way that could subsequently explain them", concludes the same author. The paper highlights how metaphor theory and terminology can work together to facilitate access to scientific concepts via description, explanation and definition. Behind the precise terminology of a given scientific field, there are living root metaphors which structure the comprehension of phenomena; as a matter of fact, metaphor theory can help shed light on some of the ambiguous aspects of terminological work.
Based on previous researches consisting of descriptions and paradigms of the scientific research in e-education [13] [14] and [15], in this approach it is developed a conceptual framework for didactics design, as it is presented in Fig. **2**.
According to the content synthesized in the image presented in Fig. **2**, knowledge represents the applications of the cognitive infrastructure developed on the terms of a language reflected as concepts, based on a design of the terminology of one or more disciplines. The cognitive infrastructure could be a human one or a simulated one, so the applications could be social or virtual. Since the application refers to an individual the knowledge is stored as experience based on education, otherwise there are developed as objects knowledge usable in knowledge transfer. As soon as the knowledge transfer has an instructional purpose, the knowledge objects become objects learning, and they are designed using didactics theories, categories, and principles. For e-learning objects the design is a computer assisted one.

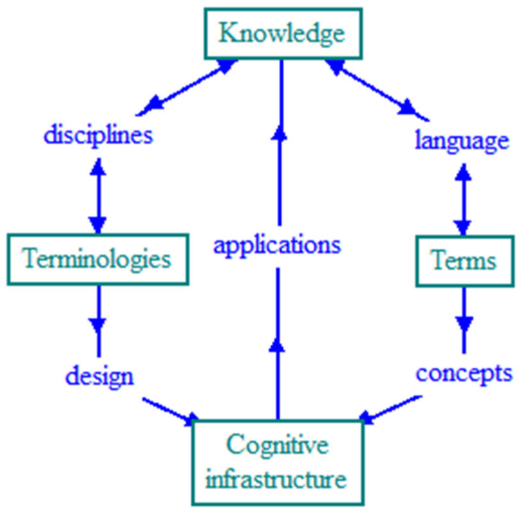

Fig. 2. The conceptual framework for didactics design

3 Theoretical Framework

E-Education analyzed as a scientific research domain, it has been developed as an attractive solution because of the important features of Information Technology resources; time and space are no more restrictions in a virtual class (e-Class), so they can lead to a more learner-oriented approach in instruction.

Previous researches [15] and [16] introduced a theoretical framework for scientific research in e-education, based on the technology approach and developed the idea that as soon as knowledge is recorded in technology and scientific research is a continuously human activity, the key of a learning society consists of in training the trainers in a dynamic technological infrastructure and in a social environment. [15] developed a theoretical case study focused on e-Class, as the first application of the e-education in a social environment.

Considering assisted instruction as a social application of the global information system, e-Classroom is defined as the first social application of the assisted instruction in e-Education. This approach reflects e-Classroom as an extension of the traditional classroom, because face-to-face teaching, learning and assessing are included; at the same time it confirms that the prefix "e" from electronic could be apply to an information system but not to an activity based on human thinking. A concepts map approach for e-Classroom is presented in Fig. 3. The model is founded on the constructivist classroom and "the pragmatic constructivism, viewed as a toolbox for problems of learning" [7]. The same author focuses on "troublesome knowledge of various kinds" and the model presented in Fig. 3 concludes that this concept requires new applications to fit the difficulties in the future, and refining the system. Refining the system involves another keyword in teaching and learning activities, threshold concept, as it is defined in [4].

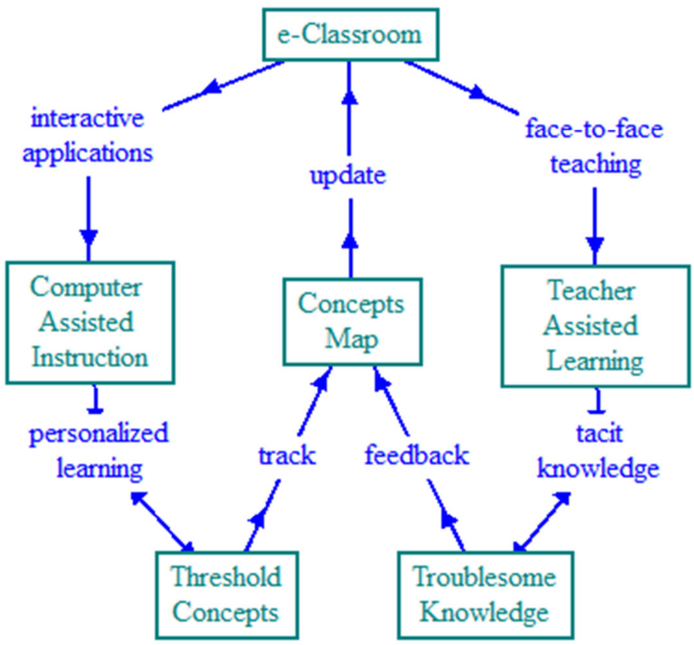

Fig. 3. The concepts map approach for e-Classroom

E-Classroom could be designed as an extension of a traditional classroom only in a standardized technological infrastructure based environment. E-Classroom integrates assisted instruction which consists of computer assisted instruction and teacher assisted learning. Computer assisted instruction represents the basis for individualized learning and, sustained with dedicated interactive applications, promotes personalized learning. Teaching assisted learning represents the social component of an e-education system which connects the process with the tacit knowledge. The student learning activity is founded on threshold concepts understanding and applying, and it is tracked as an entry in the concepts map of the discipline. The teacher role is to highlight the troublesome knowledge and to record it in the concepts map for developing the new specific interactive applications. The updated concepts map represents a base for the new version of the infrastructure of the e-Classroom. According to this dynamic medium of instruction, assisted didactics design evolves as a meta-discipline permanent improved, by default, for training the trainers in specific technological, conceptual and cognitive infrastructures. This case reflects a metaphoric deskwork, while training professionals for all others qualifications we build the paradigm of fieldwork.

4 Analytical Framework

In order to design the environment dedicated to create e-learning objects available into the e-Classroom, this approach is based on the concepts map for a didactic developing of the content, presented in [16]. The model starts from a strategic point of view consisting of a curriculum content of the educational organization, whose application stands for specific professional competencies, and which is structured in specific disciplines according with particular educational objectives, and which are finalized in correlated concepts maps, based on operational objectives.

As a conclusion of the previous works [15] and [16], *the article* could be defined as the basic result of a scientific research activity, and it could be completed as a practical case study or as a theoretical one. First situation reflects the paper focusing on the object language while the second one reveals the work concentrating on the meta-language in the scientific research. From this point of view, *the discipline* is considered the concept described as a framework for the student's study program and the concept applied as a meta-discipline designated as a framework for the scientific researcher's program. In the first case the term discipline belongs to a meta-language, while in the second case the term is included in the object language. Assisted instruction is developed as a discipline involving social, technological and cultural infrastructure and a didactic approach (see Fig. 4). The infrastructure context is a recursive one, and it functions as a default item, while the didactic approach is an iterative act, and it represents an explicit item.

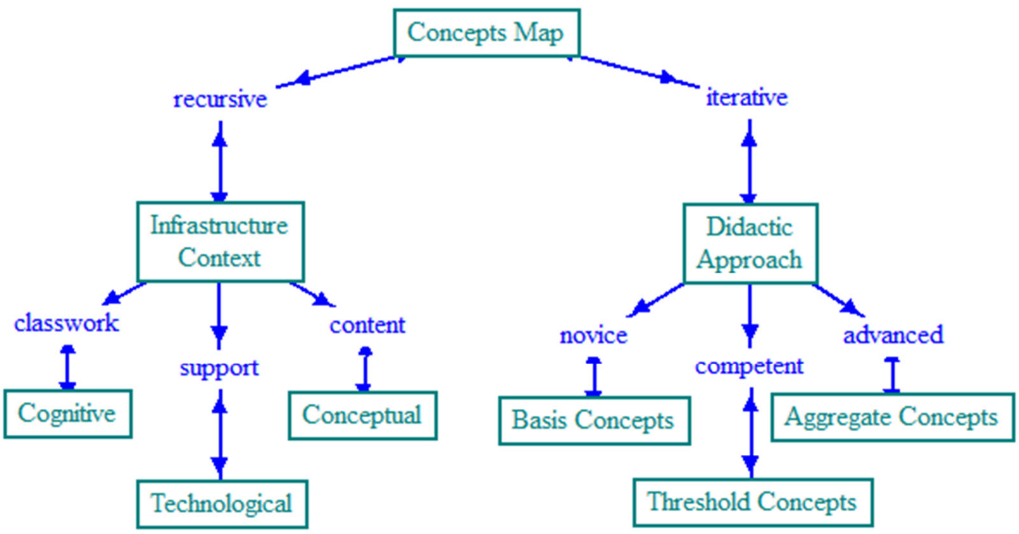

Fig. 4. Concepts map approach in assisted instruction

As soon as the teaching-learning, assessing and self-assessing process is knowledge's application, the quality of education is determined by the granularity of the content which has to be transferred when converting tacit or personal knowledge in explicit or codified knowledge. The approach of this research will be continued using the analytical framework for developing explicit knowledge elaborated in [15], see Fig. 5.

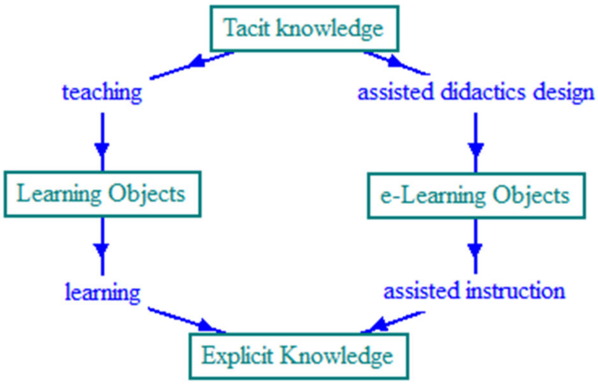

Fig. 5. The analytical framework for developing explicit knowledge

The main components of the process of conversion the knowledge educational purpose oriented reflects the main directions of the any intellectual activity: *Theory*, which is focusing on learning objects as the highest level of the content in a concept map approach and *Practice*, which is converging on e-learning objects as permanent adjustable solutions of the content delivered in e-education based on assisted instruction.

Referring to the teaching-learning activities as an intellectual process, [10, pg. 4-13] sustains: "The idea that the new knowledge germinates in old knowledge has been promoted by all of the theoreticians of intellectual development, from Piajet and Vygotsky to contemporary cognitive scientists. The notion of metaphor as a conceptual transplant clearly complements this view by providing the means for explaining the processes that turn old into new". The author concluded that "educational research is caught between two metaphors, called *acquisition* and *participation*. Each has something to offer that the other cannot provide. The introduction of an information technology into a social environment generated conditions for the immediate development of help to explain it in terms of what is already known. The problem with metaphor, however, is its ability to capture the imagination and consciousness of the user and subsequently to preclude the development of other metaphors or alternative understandings based on different connections. For every metaphor highlights one aspect of the concept, just as it hides another" [5]. In a time-line analyze, the technological infrastructure studied as an educational support, has a differentiated metaphoric effect: it is the case of the word processor, presented at the very beginning as a type writer, and which had become an assisted instruction environment for developing theoretical and practical projects for students, professors, designers, and researchers.

Analyzing the theory-practice paradigm in the process of knowledge conversion and the metaphoric technique of explaining in assisted instruction, the key of this discipline stands on the didactic approach of the content which means structuring it first as a pyramid, then developing as a network and finally, identifying the difficult situations of a learning activity. The main components used in order to enhance the teaching-learning-assessing and self-assessing activities are: training the trainers, for an enhanced classwork, technology upgrade, and refining the content.

This general preview of the mechanism of designing interactive applications is a theoretical one (as it is shown in Fig. 3), it is a pragmatic oriented model (see Fig. 4) and it has to be completed with an analytical framework, in order to explain the personal computer as a contextual environment capable to assist the process. The image presented in Fig. 6 synthesizes the personal computer created as an informatics technology (tool), developed as an educational technology (while integrating tutor function) and then, transformed as environment for designing a didactic technology enabled to support refining e-learning objects (tutee). An e-Learning object integrates competencies for the content, interaction as a support and classwork in the context of a discipline.

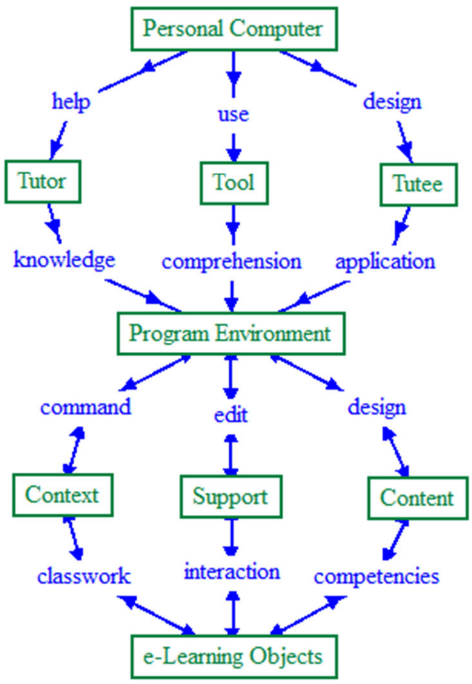

Fig. 6. The concepts map for a didactical developing of the content

6 Case Study

The case study of this approach will be founded on the theoretical framework for the e-Classroom, which it was defined in section 3. In order to respect a time-line for a classical problem, the case study is started with an example proposed in [8, pg. 22-23], which means a classical problem of a magic square, and it is solved as it is suggested by the author, then there is a transitional solution, based on the classical printed handbook and the use of the personal computer, and finally, the solution is based on an interactive applications.

The author mentions that the magic square presented scientific interests for a long time so it could be useful to come back to this subject, in a new context. In the image of the Fig. 7 could be observed the numbers of the magic square. In usual magic squares, each row and each column and each diagonal adds up to the same number. In the square presented in Fig. 7 seems to be no connection between numbers; at the same time, no rules of this type of magic square could be applied. Although the conditions are different, this square has a specific property. The author proposes a procedure in order to understand its particularity: use seven coins dimensional correlated with the square you already have drawn, so a coin could cover a number in the square. Put a coin on a number and then cover the rest numbers situated on the same row and on the same column with small pieces of paper. Put the second coin on a number selected from the 36 still visible. Cover the rest of the number situated on the same rows and on the same column with small pieces of paper. Repeat the procedure until all the 49 numbers will be covered with coins or paper. At the end, pick up the seven coins. The sum of the visible numbers is 264. Nothing seems to be interesting. The particularity of this square will be observed if the procedure will be repeated any times, covering with the seven coins any others seven numbers. Each time, the sum of the seven visible numbers will be the same: 264.

In the section dedicated to answers [8, pg. 116] the author explains: the magic square is a kind of a camouflage square, an old additive square, arranged not to be easy observed. The square is based on the values of the third rows and the values of the last column. The sum of these values is 264, and all the rest of the numbers in the square are calculated depending on these. So, we can conclude that the sum of any seven values unique on each row and unique on each column is 264.

23	17	22	46	55	72	8
19	13	18	42	51	68	4
15	9	14	38	47	64	0
26	20	25	49	58	75	11
18	12	17	41	50	67	3
35	29	34	58	67	84	20
46	40	45	69	78	95	31

Fig. 7. A magic square

The transitional solution, based on the classical printed handbook is presented in [12, pg. 62-73]. The first characteristic of this method is the individualized approach, but the same information is offered to all the readers. They can use and apply the information with the specific individual rhythm of understanding. The method implies an interdisciplinary approach, as soon as the mathematical magic square is transpose in an electronic spread sheet. A second characteristic of this method is that in the book there is a description of the interface of the numerical version 11 for the Excel environment. We have to mention that all the functionalities of this medium of instruction are included in the actual version.

In order to develop a transitional solution as a classwork, the author proposes a procedure including a number of steps described in specific terms and sustained with appropriate commands of the context; so the reader edits a range of the electronic sheet and designs the content, to be able, as a user to support the interaction, and as a student to develop his competences on this content applied in the instructional environment.

The procedure includes specific activities such as:

- Personalize the Regional Options in Control Panel for the measurement unit;
- Open an Excel session;
- Configure the number of the sheets in a new workbook;
- Configure the format of the paper, the orientation and the margins for the logical page;
- There are described and explained the contextual forms of the cursor, depending on the objects interactions;
- Resize the columns and the rows;
- Select a range and change the active cell;
- Apply the properties of the cells regarding content: format, alignment, font, borders;
- Edit the content of a range;
- Create a copy of the current sheet in the same application;
- Save the application, in a specific format, with a specific file name and in a specific folder.

The user starts to create the magic square, editing in the range A1:G7 the values presented in Fig. 7. He had to select the range and then he edits each value and press the Enter key. He creates a copy of this sheet in order to optimize checking the sum of the seven value several times. He formats the colour of the font for each of the seven value in red, then deletes all the rest of the values, apply the sum of the values in the range A1:G7 in cell A9, then copy the value from A9 in A10. He restores the values of the range copying them from the backup sheet

and formats another seven values; calculates o new sum in B9, and then the value is copied in B10. Formula edited in cell A9 could be copied in cell B9 if it used mixed address =SUM($A1:$G7).
When the user considers a boring activity repeating the same operations, he records that routine eliminating those activity creating a software routine [12, pg. 50-54]. Removing the 42 value after formatting the colour font for the seven values in red could be solved with:

```
Sub RemoveContent()
For Each cell In Range("A1:G7")
    If cell.Font.Color <> RGB(255,
0, 0) Then cell.Value = ""
Next
End Sub
```

Restoring the value in the range A1:G7, presuming that the backup exists in the sheet 1 is possible with:

```
Sub CopyRange()
Worksheets("1").Range("A1:G7").Copy
_
Destination:=Worksheets("2").Range("
A1")
End Sub
```

The first method utilized for generating the values in the magic square is based on the mixed addressing, so:

a) Select the range A1:F2;A4:F7
b) Edit the formula =A$3+$G4
c) Ctrl+Enter

The second method applied for generating the same values in the magic square is based on the name addressing, so:

a) The range A3:F3 is named rand3
b) The range G1:G7 is named coloana8
c) Select the range A1:F2;A4:F7
d) Edit the formula =rand3+coloana8
e) Ctrl+Enter

The third method used a macro procedure for filling the range with the same values, according to the observation that all the values of the magic square are calculated from two arrays: 15, 9, 14, 38, 47, 64, 0 values placed on the third row and 8, 4, 0, 11, 3, 20, 31 placed on the seventh column.

```
Option Base 1
Sub GenerateSquare()
vero = Array(15, 9, 14, 38, 47, 64,
0)
veco = Array(8, 4, 0, 11, 3, 20, 31)
For i = 1 To 7
    For j = 1 To 7
        Cells(i, j) = vero(j) +
veco(i)
    Next
Next
End Sub
```

The final solution, based on interactive applications requires preliminary configurations in the network where the e-Classroom is connected to all the necessary services: web, e-mail, and so on. It is important to distinguish between public accounts for access at the workstations or personalized accounts for each student, or if the students use public mail accounts for which each student can create a personalized profile or they use personalized mail accounts. When the access at the workstations is based on public accounts, one preliminary activity for each student is to configure the user name in the Excel environment.
This approach consists of two stages: *first*, each student receives the original enunciation, a text file coma delimited, containing the values of the magic square and a set of instructions how to do in order to understand the problem; he prepares the first response, a file which attests understanding the problem; he sends the file and, *second*, each student receives a personalized interactive application, containing a procedure detailed step by step where the described activities are supplemented with command buttons, which, on request display the exactly commands necessary to solve each step. The interactive file is prepared in a word macro-enabled format, so its window could be resize in the left-half of the desktop, so the right-half of the desktop could be used for resizing the window where the student applies the instructions and solves the problem. When the student selects a command button to see the instructions, it is

opened a message box which remains visible while he applies. This technique offers the possibility to the student to read a new method and to compare with what he knew, so he could choose the optimal one, or it could be a basic concept, an aggregate one or a threshold concept which require explanations (see Fig. 8).

While working with the interactive didactic guide, the student creates a personalized file, developing the magic square using the methods of naming the ranges, then using the mixed addressed, and in the third sheet using the macro procedure based on two arrays.

In the last sheet, the student has to format seven unique values on rows and on columns, applying the red colour to the font of these values. To other seven values, the student had to apply the style Bold to the font of the values; other seven values should be underlined. In cell A9 will be calculated the sum of the red values, in cell B9 will be calculated the sum of the bolded values and in cell C9 will be calculated the sum of the underlined values. The student has to calculate in cell G9 the sum of the values which are positioned in the range A3:F3;G1:G7.

```
Sub Compute7Values()
sum1 = 0
sum2 = 0
sum3 = 0
For Each cell In Range("A1:G7")
    If cell.Font.Color = RGB(255, 0,
0) Then sum1 = sum1 + cell.Value
    If  cell.Font.Bold  =  True  Then
sum2 = sum2 + cell.Value
    If
cell.Font.Underline=xlUnderlineStyle
Single Then sum3=sum3+cell.Value
Next
Cells(9, 1) = sum1
Cells(9, 1).Font.Color = RGB(255, 0,
0)
Cells(9, 2) = sum2
Cells(9, 2).Font.Bold = True
Cells(9, 3) = sum3
Cells(9,     3).Font.Underline      =
xlUnderlineStyleSingle
End Sub
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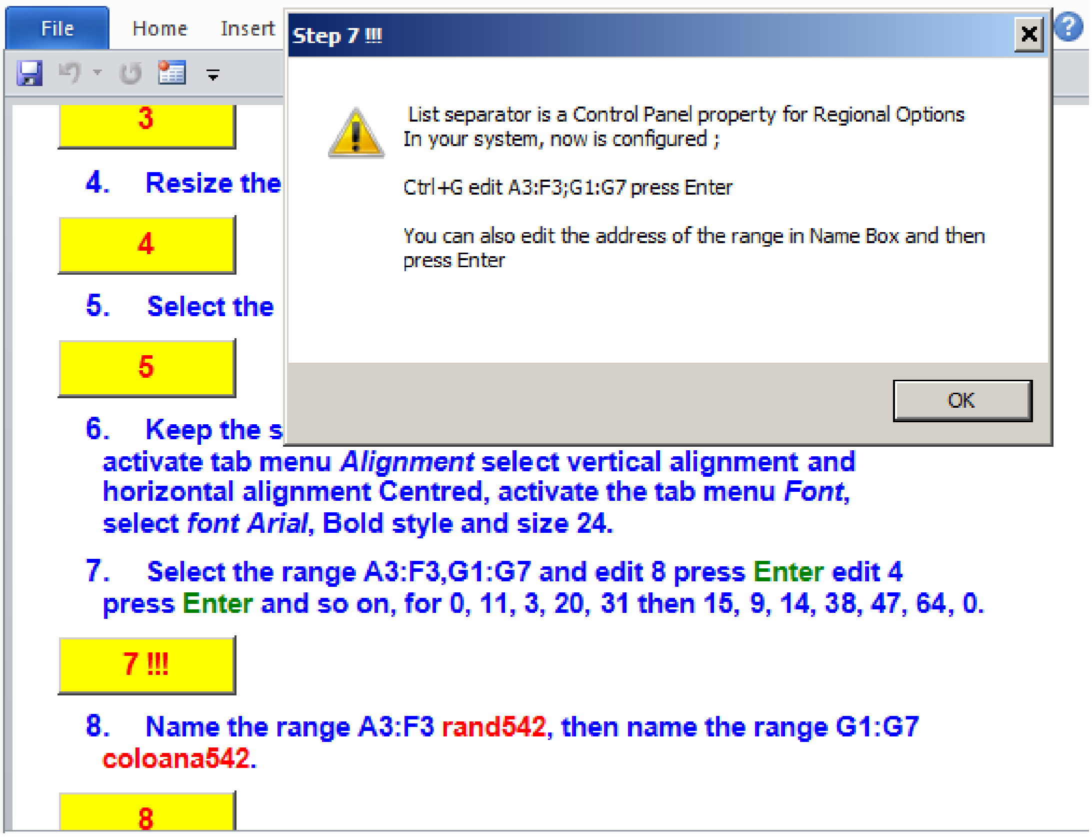

Fig. 8. Interactive classwork in assisted instruction

Finishing the first part of the interactive guide, the student edits the properties of the file he created and sends his first solution, in order to receive the application dedicated for self-examination. The student creates a copy of his initial solution, then proceeds to a verification of it using the checking-application. When the student starts the self-examination, the checking-application verifies each requirement of the interactive guide and each time when there are differences, the checker displays a specific message, mentioning the step in the guide where the method is available. When there are no more differences, the checking-application confirms the self-examination as OK displays information regarding requirements existing in the enunciation (see Fig. 9) and then, it generates a file dedicated to self-verification which has to be completed by the student in order to demonstrate understanding the content (in this case the magic square problem and the informatics environment solution), the context and the support (see Fig. 6).

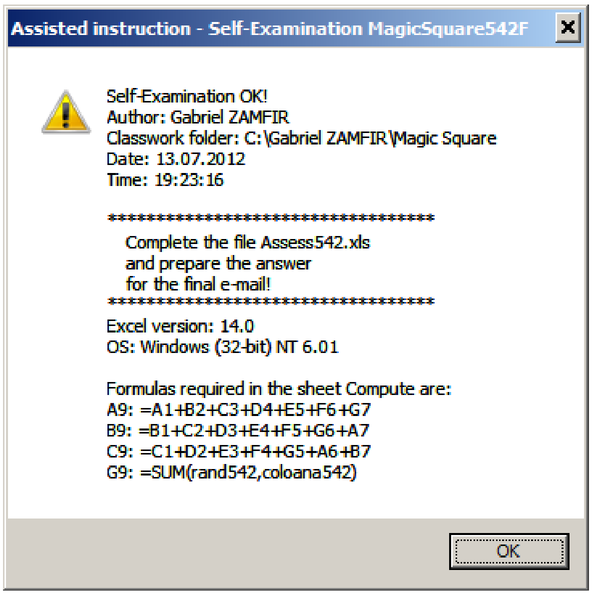

Fig. 9. The validation of the self-examination application

7 Conclusions

An e-educational scientific research program's output could become a medium of instruction for a student's study program. This result is argued by the evolution of the information technology domain, where the native development of informatics technology is through an educational one, and finally as a didactics technology. The student's study program's objectives consist of professional competencies and they are developed through disciplines' classwork. In e-Classroom, the classwork involves two variables which integrate the fieldwork in the deskwork, as an environment for the basic specific competencies. At the same time, this manner of approach develops cognitive infrastructures as extensions from social to virtual items. In e-Classroom, the discipline theorized emerges in the discipline practiced and both converge in a new discipline. This new discipline educate new generations of students, professors and scientific researchers in a recursive process instead of an iterative one.

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