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Distance learning in elementary schools in Cyprus: the evaluation methodology and results

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Abstract

During the school year 2000–2001, the Ministry of Education and Culture of Cyprus, the Department of Computer Science of the University of Cyprus and the bank of Cyprus implemented the first pilot program on distance learning in elementary schools of Cyprus, called "ODYSSEUS". The objective of this paper is to present the evaluation methodology and discuss the most important results with regard to the learning effectiveness and social implications that were realised in the students of two elementary schools that participated in the program. The combination of the new educational technologies with the traditional learning pedagogical model, the aid of learning actions that cause interaction between the students into the virtual classroom and the appointment of school as the most important point of social integration, constitute the more important conclusions of this research.

Keywords: Distance education and telelearning; Elementary education; Evaluation methodologies; Pedagogical issues; Country-specific developments

1. Introduction

The introduction of new educational technologies in elementary schools constitutes a decisive factor for the preparation of tomorrow's citizens, who will be called upon to answer the challenges of the new emerging information society.

Information Society will be the new economic and social model in the beginning of 21st century (Anastasiades, 2000a). One of the most important priorities of the developed counties throughout

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the world is to help their citizens come up to the needs of the new digital era (2001/C 292/02). As part of this endeavour, the role of our educational system is of utmost importance. The preparation of tomorrow's citizens is incumbent on the elementary schools, which ought to include the new technological applications in the educational process. The integration of new technologies in the sensitive area of a school classroom is not an easy task (Papert, 1997). The use of computers and educational multimedia, the establishment of network infrastructures and the provision of videoconference systems ensure the technological aspect of this endeavour (Harley, 2001). The technological tools and applications is the first step in the transition from the current, conventional educational system, to the new model of the virtual classroom (Norton, 2001) and the hybrid school environment (Rosbottom, 2001). At the same time, it is necessary to develop a pedagogic model, which will constitute the necessary theoretical basis and will mark out the framework where the new educational technologies will be contained.

As part of this framework, the Ministry of Education and Culture of Cyprus and the Department of Computer Science of the University of Cyprus, with the sponsoring of the Bank of Cyprus, implement the first pilot program on distance learning via teleconferencing, called "ODYSSEUS", in two elementary schools of Cyprus.

The objective of this paper is to present the critical points of a distance learning project, that was implemented in elementary schools of Cyprus at school period 2000–2001. The interest of this paper is focused in three main areas: (a) in the development of completed pedagogic methodology, that will be useful as a prototype model for the introduction of distance learning synchronous communication courses in the primary education level, (b) the development of an evaluation methodology with regard to the learning effectiveness and social implications that were realised in the students of two elementary schools that participated in the project, and (c) the discussion and the reflection concerning the most important evaluation results.

Based on the above semantic context of research, the second part of this paper presents a general description of this pilot program, together with the planning and implementation of the pedagogic model. The third part deals with the methodology of ODYSSEUS evaluation, and the fourth part presents the main results from the evaluation. Finally, the fifth part gives the most important conclusions and an outline of future research plans.

2. ODYSSEUS: a pilot program on distance learning between two elementary schools in Cyprus (school period 2000–2001)

2.1. General description plans

The ODYSSEUS program is the pivot of a collective endeavour, with the participation of the Ministry of Education of Cyprus and the Department of Computer Science, University of Cyprus. The students and teachers of the two elementary schools that participated in the program were the main component parts of an open learning environment. The elementary schools that participated in the pilot program (Helenio Elementary School of Nicosia and Elementary School of Limassol) have already considerable experience in the area of videoconference through

OIKADE program (www.oikade.gr). The main objective of this program is to form a cultural and intellectual bridge over schoolchildren from Cyprus, Greece and all around the world (Anastasiades, Eleftheriou, & Xambiaouris, 2001).

2.2. Targets of the program

The main target of this pilot endeavour is to familiarize students with a step-by-step hybrid-learning environment (Anastasiades, 2002). By "hybrid" we mean a learning environment where an optimal combination of the new educational technologies and traditional pedagogic methodologies is attempted (Anastasiades, 2000b). The methodology applied will enable the students be active components of an interactive learning strategy plan.

2.3. The pedagogic model

During the last 30 years, there has been quite some discussion on distance learning models, as distinct and separate from the traditional learning model. Some of these models include the methodology of independent study (Wedmeyer, 1977), the learner autonomy (Moore, 1972, 1994) and interaction and communication (Holmberg, 1989). A comparative analysis of all such theories recognizes their importance but realizes that they cannot be considered a complete pedagogic model (Keegan, 1993). "In our days, distance learning is becoming more traditional, while traditional learning is using techniques formally associated with distance" (Picciano, 2001). From this point of view, it is not necessary to develop a different theory for distance learning, but a new, common theory, "that merges distance education and traditional education, should be considered and pursued instead (Clark, 1983)". By adopting Clark's theory we get a different dimension on the significance of a hybrid educational environment.

The transition from the current model of the conventional classroom to the new hybrid-learning environment is not a light matter, since there are several factors obstructing the efforts towards renewing and changing existing conditions (Anastasiades, 2002)

To achieve this, the methodology worked out is based on the school of social bibliography (Dede, 1996; Eastmond, 1995; Jonassen, 1995; Mathiews, 1992; Wiesenberg & Hutton, 1995), according to which the new technologies have to be introduced in the classroom for pedagogic, social, financial and political reasons. This means that emphasis is placed on the teacher as a cultural intermediary during the learning process in its new form, while the social consequences of the new technologies need to be constantly assessed.

According to the ADEC Guiding Principles for Distance Teaching and Learning the current methodology accept the following basic assumptions:

- The principles that lend themselves to quality face-to-face learning environments are often similar to those found in web-based learning environments.
- With all forms of media converging to a digital platform, advanced educational technology may include a variety of learning environments and information appliances.
- While rapidly emerging technologies offer unlimited potential for virtual learning environments for both face-to-face as well as distance learners, practical application of existing technologies may often prove highly effective for various audiences and objectives.

Principles:

- The learning experience must have a clear purpose with tightly focused outcomes and objectives. Web-based learning designs must consider the nature of content, specific context, desired learning outcomes and characteristics of the learner. Learner-centered strategies include modular, stand-alone units that are compatible with short bursts of learning. Learning modules may also be open, flexible and self-directing.
- The learner is actively engaged. Active, hands-on, concrete experiences are highly effective. Learning by doing, analogy and assimilation are increasingly important pedagogical forms. Where possible, learning outcomes should relate to real-life experiences through simulation and application.
- The learning environment makes appropriate use of a variety of media. Various learning styles are best engaged by using a variety of media to achieve learning outcomes. Selection of media may also depend on nature of content, learning goals, access to technology, and the local learning environment.
- Learning environments must include problem-based as well as knowledge-based learning. Problem-based learning involves higher order thinking skills such as analysis, synthesis, and evaluation while knowledge-based learning involves recall, comprehension and application.
- Learning experiences should support interaction and the development of communities of interest. Learning is social and sensitive to context. Learning experiences based on interaction and collaboration support learning communities while building a support network to enhance learning outcomes. Multiple interactions, group collaboration and cooperative learning may provide increased levels of interaction and simulation.

The development of a distance learning methodology requires a special pedagogic approach, designed to achieve the best possible results (Egan, 1991; Sclosser & Anderson, 1994). This section presents the basic components of the development of ODYSSEUS pedagogic model, which include the development of a teaching methodology, the specification of teaching modules, the delineation of a communication model, the classroom architecture, the selection of a technological infrastructure and, finally, the design of an organisational and supporting model. The current pedagogic model follows the methodology of the Instructional Model (Dick & Carey, 1990; Gustafson & Powell, 1991) and particularly the stages of planning, development, evaluation and revision

2.4. Development of the teaching methodology—implementation process

The students will get in contact with the new teaching model progressively, in order to become a part of the new learning environment as smoothly as possible. This will be achieved through the implementation of four stages: a preparatory period, distance teaching, virtual class and telecooperation (Fig. 1).

2.4.1. Phase A: preliminary period

Based on the above methodology, the steps of the approach are described as follows:

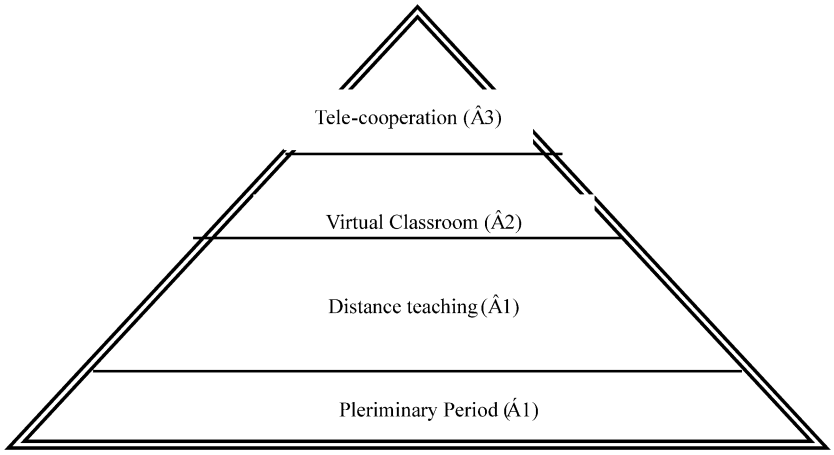

Fig. 1. The stages of the teaching methodology.

A1. *Familiarization of the teachers with the new reality*: A1.1, Familiarization of educators with the basic traits of the new learning environment. (new roles, pedagogic concerns etc.). A1.2, Seminars providing basic knowledge on computers and the Internet. A1.3, Familiarization with educational interactive multimedia. A1.4, Knowing how to use the required technological tools in order to implement the procedures of teleconference and tele-cooperation. A1.5, Psycho-pedagogic approach of the new environment. A1.6, Techniques of encouraging and supporting students.

A2. *Preparation of training units (schools)*: A2.1, Provision of all the necessary technological means and applications. A2.2, Software. A2.3, Hardware. A2.4, Communicational status. A2.5, Networking of schools. A2.6, Hiring of specialized technical personnel in order to support the instructor on technical matters.

A3. *Preparation of parents (associations etc.)*: A3.1, Informing the parents that their child will take part in the pilot program. A3.2, Brief seminar in order to get the parents: understand the importance of it, trained, in order to support their child as needed, avoid exaggerations (overwhelming pressure to get the child adjusted, negative predisposition and indifference towards the undertaking).

A4. *Preparation of the trainees (students)*: A4.1, Introductory briefings on the pilot program. A4.2, Familiarization of the students with computers. A4.3, Familiarization of the children with educational multimedia. A4.4, Familiarization of the students with the new learning environment (showing on video teleconferences of other schools, etc.).

2.4.2. Phase B1: distance teaching

B̂1.1 *Description of the action*: The course will be taught by the teacher of Limassols Elementary School and will be attended by both the students of his class and the students of Heleneio by teleconference. At a scheduled time the two classes will be ready for action B̂1. As soon as the teacher is done with his teaching, teleconference is ended and the students of both classes bring up questions and talk on various subjects with the teachers in their conventional classrooms. Objective of this phase is to familiarize the teachers and students with the concept of Distance teaching.

Β̂1.2 *Evaluation*: Β̂1.2.1, Students' Evaluation (evaluation of knowledge, experience from the teaching etc.) by the teachers. Β̂1.2.2, Teachers' Evaluation (noting down problems, ways of solving them, alternate approaches etc.) by the teachers themselves in cooperation with other teachers, specialists etc. Β̂1.2.3, Evaluation of the procedure. Β̂1.3, Recording of the evaluation results.

Action Β̂1 is done a second time, with the teachers reversing their roles in order to play the roles of active and pas

2.4.3. Phase B2: creation of the virtual classroom

Β̂2.1 *Description of the action*: The creation of a complete learning environment is attempted in this phase, where the whole lesson period will be covered by teleteaching and where questions from both classrooms will be encouraged (discussion—exchange of ideas—other activities). This phase is aiming at the creation of the necessary conditions in order to unfold all the activities that take place in a conventional classroom. Teachers and students familiarize themselves with the idea of the virtual classroom. Β̂2.2, Evaluation. Β̂2.2.1, Students' evaluation (evaluation of knowledge, experience from the teaching etc.) by the teachers. Β̂2.2.2, Teachers' evaluation (noting down problems, ways of solving them, alternate approaches etc.) by the teachers themselves in cooperation with other teachers, specialists etc. Β̂2.2.3, Evaluation of the procedure as a whole. Β̂2.3, Recording of the evaluation results.

2.4.4. Phase B3: tele-cooperation: development of joint activities between teleclassrooms

Β̂3.1 *Description of the action*: In this phase we have an attempt to create an open cooperative environment between the active students of the two classes. Basically, we have an attempt to create a work group that will be in cooperation from a distance, in order to carry through a joint activity.

During this phase, the students are the leading actors in the new cooperative environment, while the teachers play a rather supervising-guiding role, interfering whenever they find it necessary. Β̂3.2, Evaluation. Β̂3.2.1, Self-evaluation of the students (evaluation of the procedure by the students themselves). Β̂3.2.2, Students' evaluation by the teachers (noting down problems, ways of solving them, alternate approaches etc.) by the students themselves in cooperation with other students, specialists etc. Β̂3.2.3, Evaluation of the procedure as a whole. Β̂3.3 Recording of the evaluation results.

2.5. The specification of teaching modules

The implementation of pilot programs should abide by the basic principles that form the foundation of a country's educational system, and also the peculiarities of a school. Adjusting the above principles to the Cyprian scene and the special needs of the two schools resulted in a self-reliant methodology having the following main characteristics:

- Acceptance and use of the existing detailed curriculum given by the Ministry of Education of the country implementing the program.
- Acceptance and use of the dominant teaching methodology and adjusting it, as much as possible, to the scene of the new learning environment.

- Development of electronic educational material by the teachers and the students of the schools.

Continuous and complete evaluation of all the stages on the basis of a specific methodology (Table 1).

2.6. The communication model methodology

The methodology was chosen as a result of the seminar that was organized by the Department of Computer Science, University of Cyprus (Anastasiades et al., 2001). This methodology combined with the application of the three models method of Maryland University, USA, and particularly model A (IDE, 1996) that is a large teleclassroom composed of groups of students in two or more distant locations. The presence of teachers into the classrooms was judged imposed, because the age-related structure of audience (Fig. 2).

2.7. The classroom architecture model

The methodology chosen is that of separating the audience into active and passive. The active audience consists of 6–8 students who sit in a triangle on the top of which we find the teacher and

Table 1
Teaching sections and course schedule

Phases	Course Schedule	Teaching Section	Teacher
Β̂1: Distance Teaching			
Β̂1.1 Distance Teaching (DT1)	14–3-2001	Dionysios Solwmos - Hero's of Mesologgi (Book: My language, Fifth Class pp. 121)	A. Eleutheriou
Β̂1.2. Distance Teaching (DT2)	15–3-2001	Κ̂είμενο «The Exit of Mesologgi» History School book. Sixth class, pp.149–150	K. Xambiaouris
Β̂2: Virtual Classroom			
Β̂2.1 Virtual Classroom (VC1)	21–3-2001	"Kremydas" (Book: My language, Fifth Class pp. 121)	A. Eleutheriou
Β̂2.2 Virtual Classroom (VC2)	28–3-2001	Poet: «Euagoras Palikaridis» (Book: My language, Fifth Class pp. 120)	K. Xambiaouris
Β̂3: Tele-cooperation (TC)	29–3-2001	'A hero Cypriot Student' K.Mondi (Language School Book, pp.207)	A. Eleutheriou & K. Xambiaouris

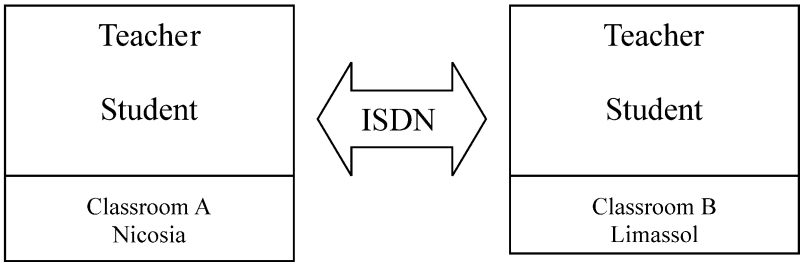

Fig. 2. The communication model.

the blackboard (Anastasiades, 2002). The students of the active audience alternate during the lessons, so that all the students of each class experience the pilot program.

The methodology was chosen as a result of the seminar that was organized by the Department of Computer Science, University of Cyprus (Anastasiades, submitted for publication). This methodology combined with the application of the three models method of Maryland University, USA, and particularly model A that is a large teleclassroom composed of groups of students in two or more distant locations (IDE, 1996).

The conceptual convergence of model A with the separation of the audience into active and passive groups, forms a transitory approach of original methodology which from now on will be referred to as Transition Methodology, and will be marked by the alternation of active and passive audience as part of model A. Transition methodology ensures equal participation of all the students of the class in the new learning environment, without upsetting the relation of the students to the existing structure of the traditional school schedule, as it should not elude us that the pilot program is implemented during the operation of the two schools (Fig. 3).

2.8. The technological infrastructure

The technological model per school unit is supported, from three ISDN lines, one dial up Internet connection, one television, one camera, one video, one computer and one telephone appliance. Bank of Cyprus technicians provide the technical support.

2.9. The organization and support model

This model fixes the roles that will play the partners of the project 'ODYSSEUS'.

The Ministry of Education and Culture of Cyprus, has the responsibility of the schools, teachers and students that participate in the project. The department of Computer Science of the University of Cyprus undertake the scientific co-ordination of the project. In this frames it had

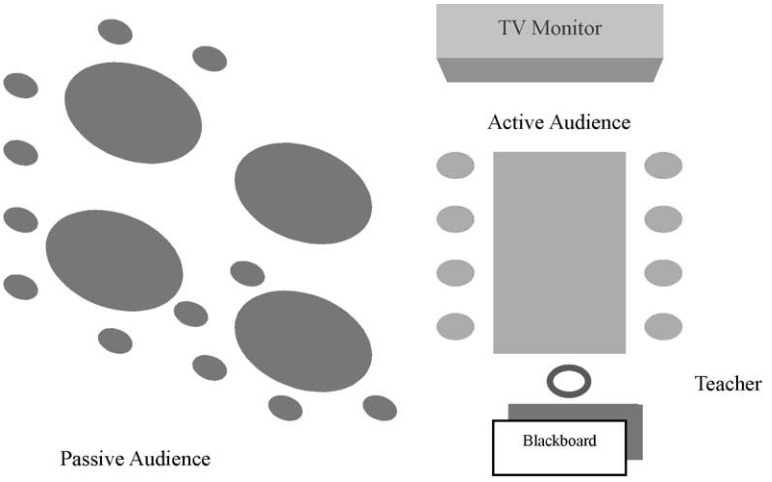

Fig. 3. The classroom architecture model.

the responsibility of instructive methodology development, and evaluation process, the geographic dimension of program, the planning of action of dissemination etc. The Bank of Cyprus it will have the responsibility for supplying the selectively schools of Cyprus with the suitable technological equipment. At the same time it will undertake the economic support of program.

The organizational and support model constituted three committees. The monitoring committee, which composed from certain representatives of institutions, has the general monitoring responsibility of the project. The research committee has the planning and implementation responsibility of the project. Finally the organizational committee has a general supporting role. Dr. Panagiotes Anastasiades has the scientific responsibility of this project.

3. Evaluation methodology of the ODYSSEUS program

The elaboration of an evaluation methodology for the ODYSSEUS program is one of its most important components. It was a decisive factor in revealing certain weak points in the teaching and pedagogic methodology at pilot stage, and at the same time it brought to light unknown, heretofore, instructional and social aspects of our endeavor. We are now going to analyze the evaluation methodology of ODYSSEUS.

3.1. General principles

The most widely used method for the evaluation of distance learning programs concerns higher education and introduces a four-point evaluation system (Keegan & Rumble, 1982). Evaluation focuses on the quantitative data of the educational institution that provides distance-learning programs, on the quality of the education provided, on the prestige of the said educational institution and, finally, on the relevant cost of the education provided.

Moreover, a considerable number of scientific projects have focused on the evaluation of distance learning programs (Dasher-Alston & Patton, 1982; Henderson, 2001; Malone, Malm, & Thompson, 1998; Rowland, & Rubbert, 2001).

Evaluation is the collection, the analysis and the interpretation of information about any aspect of a programme of education or training as part of a recognised process of judging its effectiveness, its efficiency, and any other outcomes it may have (LTDI, 1998). Evaluation should be a planned systematic and open endeavour (Calder, 1995, Rowntree, 1994). The methodology of ODYSSEUS program concern the learning event at a holistic level, taking into account the context of learning and all the factors that go with it. However, the peculiarities of a distance-learning program implemented in an elementary school necessitate the development of a complete methodology that will answer the special needs and requirements of such an endeavor.

3.2. Planning the evaluation methodology "ODYSSEUS"

The evaluation methodology proposed as part of the ODYSSEUS program follows a procedure of 11 steps as follows.

3.2.1. Evaluation target

Main target of the evaluation is to detect elements and data that will contribute to a continuous improvement of the teaching methodology in real time.

3.2.2. Object of the evaluation

The object of the evaluation is divided into two main levels: teaching-pedagogic and social.

The objective of the proposed methodology at a teaching level is the evaluation, on the part of the students and instructors, of the teaching methodology that was used. Pointing out the weak points in the planning and implementation of the various subjects to be taught, spotting good practices that should be promoted further and, finally, estimating the friendliness, efficiency and effectiveness of the teaching methodology were the key points of the evaluation.

At a social level, we were concerned about whether the distance learning process changed—and in what direction—the impression and idea of the students about their teacher, schoolmates and the area of their school as an institution of socialization.

3.2.3. Subject of the evaluation

The evaluation methodology is targeting the students, the instructors and the components of the new learning environment (technological equipment, educational technologies, subjects etc.).

3.2.4. Evaluation performers

Evaluation is carried out by the students themselves, the teachers, the support team (university students and scientific collaborators), and, finally, the research team of the program.

3.2.5. Safety valves of the evaluation

The introduction of the new communication and information technologies in elementary schools requires special attention. The evaluation procedure of a distance-learning program becomes difficult, since the trainees, due to their age, cannot easily grasp its importance. In order to secure the targets of the evaluation, the teachers and the program manager need to apply considerable effort, both during the planning and the implementation stage.

So in order to secure the reliability of the results, four safety valves are being introduced. The first includes the special mention of the teachers to their students about the importance of the questionnaires. The second relates to the time allowed for the students in order to fill out the questionnaires after each teleconference session. The third safety valve provides for a very small number of pilot questions, whose answers are considered given, to a reasonable degree. Thus, considerable deviation from these answers suggests low reliability of the results. Finally, a limited number of questions repeat themselves with different wording. Purpose of this technique is to ensure that the questionnaires are filled out as carefully as possible.

3.2.6. Evaluation criteria

The methodology worked out as part of ODYSSEUS program introduces the following evaluation criteria, whose purpose is to answer the priorities described above, that is the evaluation of the program both at a level of teaching methodology and at a level of social impact (Fig. 4).

Evaluation of the students' technological status: Ascertaining and recording the knowledge of the students participating in the program as to the new communication and information technologies.

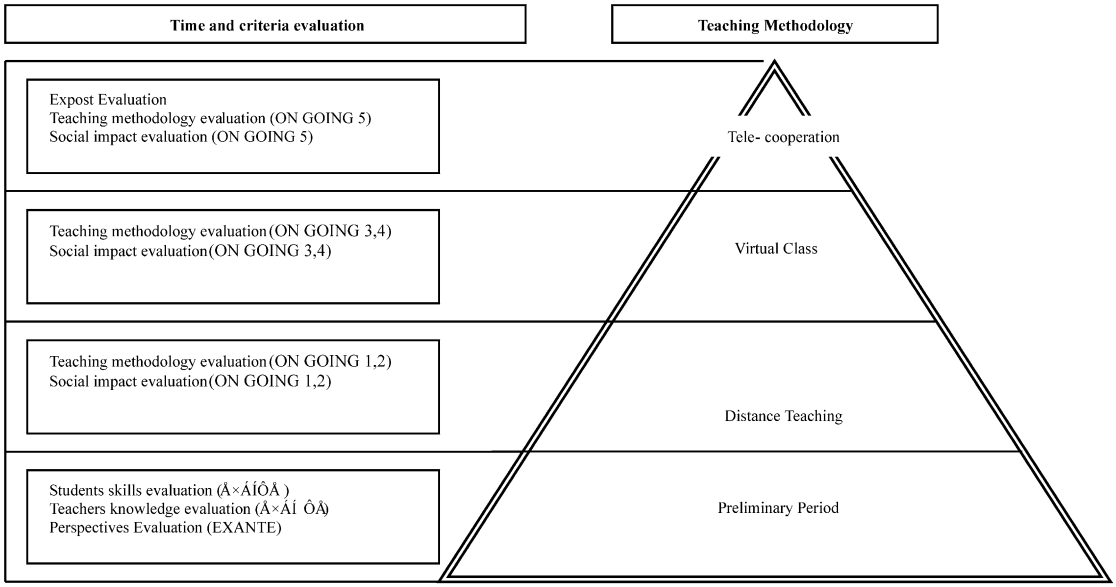

Fig. 4. The relation between the teaching methodology, evaluation against time and evaluation criteria.

- Description: Through a set of questions, we seek to find out what do students know about computers, the possibility and usage level of the basic software applications, internet and other features, such as the use of educational software, participation in teleconference sessions etc.
- Target: To record the students' technological knowledge and abilities.
- Method: Self-evaluation of the students through a questionnaire.
- Implementation: Planning of easy and comprehensible questions with scales of answers: Excellent, Very good, Good, Fair, None.

Evaluation of the teachers' technological status: Ascertaining and recording the knowledge and skills of the teachers taking part in the program.

- Description: Graduate and postgraduate studies, special knowledge in educational technologies etc.
- Target: To record the teachers' technological knowledge and skills.
- Method: Self-evaluation of the teachers through a questionnaire.
- Implementation: Planning of questions with scales of answers: Excellent, Very good, Good, Fair, None or, alternatively, analysis of curriculum vitas.

Evaluation of technological equipment: Recording potential technical problems.

- Description: Detecting any technical problems in the evaluation system (sound, image etc.).

- Target: To spot and remedy any technical problems.
- Implementation: Development of reports.

Evaluation of the learning effectiveness on the part of the students: A close look into the friendliness, usability and effectiveness of the teaching methodology.

- Description: Through a set of questions, we seek to find out whether the students found it easy and pleasant to attend the course in its new form, what was their impression on the teachers' communication level, if they got distracted during the course of teaching etc.
- Target: To spot any weak points and indicate good practices during the implementation stage of the teaching methodology, and especially the learning effectiveness of this type of distance learning project.
- Method One: Self-evaluation of the students. Implementation: Planning of easy and comprehensible questions with scales of answers: I totally agree (5), I agree (4), I don't know (3), I disagree (2), I totally disagree (1).
- Method Two: Evaluation of students by their teachers.
- Implementation: Verbal questions and discussion between teachers and students during the lesson period.

Evaluation of learning effectiveness on the part of the teachers: A close look into the effectiveness and usability of the teaching methodology.

- Description: We seek to record the teachers' views as to whether the new educational environment was friendly and pleasant or not, the attention level of the students, the evaluation of the courses' preparation etc.
- Target: To locate any weak points and indicate good teaching practices during the implementation stage of the teaching methodology.
- Method: Self-evaluation of teachers.
- Implementation: Development of reports.

Evaluation of the social impact from the students' standpoint: A close look into the social impact and the relations between the students and their school environment in its new form.

- Description: Based on a number of structured questions, there was an effort to outline the impression of the students regarding the schoolmates of their own class and also the schoolmates of the other class they contacted through teleconference, their teachers etc.
- Target: To outline the impression of the students about their school as a place of incorporation into the society, before, during and after the end of the teleconference sessions.
- Method One: Self-evaluation of students. Implementation: Planning of easy and comprehensible questions with scales of answers: I totally agree (5), I agree (4), I don't know (3), I disagree (2), I totally disagree (1).

- Method Two: Evaluation of students by their teachers.
- Implementation: Verbal questions and discussion between teachers and students during the lesson period.

Evaluation of the social impact from the teacher's standpoint: A close look into the social impact and particularly into the relationship of the students with their teachers and the relationship of the teachers with each other.

- Description: Recording any changes in the attitude of the students during the conventional courses, as well as during teleconference sessions, level of relations between teachers and students etc.
- Target: To outline the teachers' idea of the students and their school as a place of incorporation into the society, before, during and after the end of the teleconference sessions.
- Method: Self-evaluation of teachers.
- Implementation: Development of reports.

3.2.7. Evaluation against time

As we already mentioned in Section 2, the teaching methodology is based on the implementation of tele-teaching, virtual classroom and tele-cooperation stages.

In order to meet the demands of the ODYSSEUS program, the evaluation methodology should evaluate all three stages as a whole, as one system. Consequently, the evaluation methodology presented as part of this paper introduces the idea of timing the evaluations at a level of EXANTE-ONGOING & EXPOST, allowing us to dynamically monitor against time the tendencies that are formed from lesson to lesson based on the evaluation criteria as presented above.

Exante evaluation notes the expectations of the students and the teachers in relation to the distance teaching program. The students fill out a questionnaire just before the start of the program, and the teachers turn in a report.

On-Going evaluation is the tool recording the tendencies being formed according to the evaluation criteria. This action requires the filling out of five questionnaires by the students: two questionnaires at tele-teaching stage, two questionnaires at virtual classroom stage and one at tele-cooperation stage. At the end of each stage, teachers and research team note down any remarks, comments etc. Expost evaluation notes the impressions of those participating in the program (students and teachers), right after the end of the program. Students fill out a final questionnaire, and the evaluation is completed with a live discussion among the students that participated in the program, which also gets recorded on video. The recorded contents of the discussion are additional evaluation material, which gets produced in the form of a report. The teachers turn in their final report.

3.2.8. Evaluation tools

The evaluation tools being used are the questionnaires, the reports and the personal or group discussions that get videotaped. The students fill out questionnaires throughout the teaching program and at the end there are group discussions, which get recorded on VIDEO for further

evaluation of certain points that came up during the evaluation. In addition to any comments they have throughout the implementation stage, the teachers turn in a final report with a particular structure, which at the same time prompts them to touch any point they consider important according to their judgment. Similar reports are also written by the support and research team of the program, who attend all teleconference sessions.

3.2.9. Data collection—data processing-analysis

Data collection is performed right after the questionnaires are filled out, whereas the reports and group interviews take place after the end of the program. The questionnaires' data is processed by means of spreadsheets, and the use of statistical package SPSS is programmed as well. The reports and group interviews are processed based on the methodology used in quality analysis.

3.2.10. Presentation of results

The results are presented in a structured manner.

For the presentation of the questionnaire results, there are charts prepared which present the object to be evaluated and give an average of the answers, based on a scale from 1 to 5. [I totally agree (5), I agree (4), I don't know (3), I disagree (2), I totally disagree (1)]. They also give a comparative analysis of the results and the main points in the form of conclusions. Finally, certain improvement actions are being suggested. The results from the reports and group interviews are presented in the form of points and remarks. At the end, the results from the questionnaires, the reports and the group interviews are the principal material used for putting together the final evaluation report, which lists out the final conclusions of the research and proposes certain improvement measures.

3.2.11. Utilization of results

The utilization of the results is dynamic, in the sense that the evaluation results of a certain stage can influence the implementation of the next stage, by making immediate decisions if such is deemed necessary. Main purpose of the evaluation results is the improvement of the teaching system on a long-term basis (Table 2).

4. Data analysis and results

In this section are presented the results of student's evaluation that took part in the ODYSSEUS program. The review of results requires a cross-correlation of the evaluation criteria that have been set with the respective stages of the teaching methodology implementation and the concept of evaluation against time. Otherwise, many of the conclusions will go in a wrong direction. The deductive analysis of the evaluation results is as follows:

4.1. General overview

Schools: The elementary schools, which participated in the pilot program, are Elenio Primary School of Nicosia, and the 19th Primary School of Limassol. Both schools are equipped with computers laboratories.

Table 2
The 11 steps of the ODYSSEUS evaluation methodology

Evaluation steps	Description
1. Evaluation target	Improvement of learning system methods and tools
2. Object of the evaluation (definition of the evaluation's scope).	Evaluation of the teaching and pedagogic approach
	Recording and evaluation of the potential social impact
3. Subject of the evaluation (who gets evaluated)	Students
	Teachers
	School
	Technological equipment and educational tools
4. Evaluation performers (who evaluate)	Students
	Teachers
	Support team
	Research team
5. Safety valves of the evaluation	Development of techniques to secure the reliability of the results
6. Evaluation criteria	Evaluation of students' knowledge and skills
	Evaluation of teachers' knowledge and skills
	Evaluation of technological equipment
	Evaluation of the teaching methodology by the students
	Evaluation of the teaching methodology by the teachers
	Evaluation of the social impact by the students
	Evaluation of the social impact by the teachers
7. Evaluation against time	Ex ante
	On Going
	Ex post
8. Evaluation tools	Questionnaires
	Reports
	Group interviews
9. Data collection—data processing-analysis	Collection of data is immediate and continuous
	Spreadsheets
	Quality–quantity analysis
10. Presentation of results	Homogenized charts
	Structured reports
	Suggestions for improvement actions
11. Utilization of results	Immediate
	Ex post

Students: More than 50 students from fifth and sixth class, 23 boys and 28 girls, got involved with the pilot project.

Teachers: Two teachers participated.

Technological equipment: The equipment is constituted from three ISDN lines, one dial up Internet connection, one 28″ television, one camera, one video, one computer and one telephone appliance.

Technical support per school unit: technicians with whom it has a contract with the Bank of Cyprus provide it.

4.2. Students skills and knowledge evaluation

Data analysis: The majority (80%) of students declared that they are PC users. Almost all students can use the Internet, while most declared mediocre users of electronic mail. Seventy per cent of students have a PC in their house and use it many times every week. All of students declared that they have participated in the process of a videoconference, but nobody has participated in a distance learning process.

Results: The students' knowledge and skills with regard to computers, the Internet and the most important software applications were exceptional for the level of students going to elementary school. Another important point we should stress is that all the students were already experienced with videoconferencing, since they had attended the OIKADE program.

All the students had the essential knowledge and skills necessary to participate in a distance-learning program

4.3. Teachers skills and knowledge evaluation

Data analysis: Mr. Xampiaouris and Mrs. Eleutheriou are postgraduate degree holders and they have high-level skills in educational information technologies

Xambiaouris Kwstas has graduated from the Pedagogical Academic of Cyprus in 1986 where he studied Primary Education. From 1994 to 1999 he was the Information Technology Coordinator for Primary Education for the Limassol district. In 1996 he obtained the degree of Education of the University of Athens Greece. During 1997–2000 he attended the graduate school of the University of Cyprus where he obtained an MA in Mathematics Education.

He represented the Ministry of Education and Culture of Cyprus in seminars in Cyprus (''Second Pancyprian Seminar of Mathematics'', December 1998) and abroad (''Partner Finding for Comenius'', Alden Biesen, Belgium, May 1998). Moreover he participated in many other seminars presenting his own work in some of them. He has participated in the European Educational Program ''Socrates'' since 1998, and cooperates with schools from the United Kingdom, Denmark, Finland and Austria. Furthermore he has participated in the Program ''Oikade'' since 1999, and program ''Odysseus'' since 2000. He has worked in Cyprus Primary Schools for 16 years. In the fall of 2000 he became a PhD candidate of the Department of Education on Primary Education of the University of Athens Greece.

Mrs. Eleytheriou has undergraduate studies (the P. I. C. for Primary School Teachers—Pedagogical Institute of Cyprus—June 1993), and graduate studies at the University of Manchester in Educational Studies (Science and Information Technology in Primary Education—December 1994). She has been a primary school teacher in governmental primary schools since 1991 and also Primary School Teacher and Coordinator for the implementation of IT in Primary Education of Cyprus (Curriculum Development Unit, 1994–1998). She is also School Coordinator of the ''Oikade'' Project—Electronic Journeys of Cypriot Students all over the World via videoconference (since 2000). She is a member of the Implementation Committee of the Pilot Program Odysseus:—Long Distance Learning Educational Program (since 2001).

Results: The teachers of ODYSSEUS had postgraduate studies in educational technologies. The level of teachers that participated in the program was adequately high. They had a great deal of experience on conventional teaching and videoconferencing as well. It is obvious that these two

teachers have the essential cognitive background, but also the required technological skills, to be selected as members of the didactics team of program.

4.4. Evaluation of technological infrastructure

Data analysis: The quality of picture is good enough. The camera comes with a remote control, so we didn't have the facility of automatic focusing. We had many problems with the sound system. This problem was realised at the first videoconference. The main cause of this problem was technical; the transmitted sound was not clean. This problem was reported immediately to the technical team of program, which supplied us with a new advanced technology microphone, which isolates the noise and transmits completely clean speech. A second factor, which influenced the quality of sound, was the various movements that made by the small students on their desks (the locomotion of pencils etc.); they created important interjections in the quality of sound. The initial constitution of schoolteachers was not effective. The solution was found when we placed on the desks special buckram, which disappeared almost the noise. As a result of these two suggestions was the exceptional quality of sound that we had at the duration of program.

Results: The system of videoconferencing did not support automatic focus techniques. The three ISDN lines ensured sufficiently good image quality; the quality of sound broadcast was problematic, causing considerable difficulties in the process of videoconference. Corrective interventions as they described above help us to solve this problem.

4.5. Students expectations (EXANTE EVALUATION) (Table 3)

Data analysis: The students found it positive that they would be able to communicate with the teacher of another school through a television set, but they made a clear distinction between having the teacher physically in the classroom and being taught through a screen. Although they received very positively the fact that through the screen they would be able to communicate and cooperate with their schoolmates, they said that they are completely against the possibility of attending their courses from home, without coming to school. Moreover, the students themselves recognize that the school, the play in the schoolyard and their friends in the classroom are the most important elements of their school life. As they were already familiar with Oikade, they had

Table 3
Students expectations (EXANTE EVALUATION)

Questions	Average
I agree with the idea that I can communicate with my teacher through a TV screen	3.4
I agree with the idea that I can communicate with my schoolmates through a TV screen	4.1
I would like to attend the courses through a PC monitor	2.2
I would like to collaborate with my schoolmates through a PC monitor	4.1
I would rather attend the courses from my house through a screen, without coming to school	1.6
My school and my relation with the other children are very important to me	4,5
I met my best friends at school	4.8
The presence of my teacher in the classroom is not very important to me	1.3

I totally agree (5), I agree (4), I don't know (3), I disagree (2), I totally disagree (1).

less reservations than one might expect in regards to the possibility of attending through teleconferencing those courses which are conventionally taught in the classroom.

Results: The students, due to their familiarity with the Oikade project, stated that they are quite positive in regards to communicating with teachers and schoolmates through teleconferencing, while they consider that the physical contact with their teacher in the conventional classroom is irreplaceable. At the same time, they give highest priority to the social role of the school in its current form.

They seem to have reservations in regards to attending their courses through teleconferencing from now on. This result is considered to be natural, since it is the first time they will be taught this way.

4.6. Evaluation of learning effectiveness of the teaching methodology—students' view (ONGOING EVALUATION 1,2,3,4,5) (Table 4)

Data analysis: The students said that they found the teaching method quite friendly. It is important to mention the changes in attitude that were noted, as a matter of course, from one implementation stage to the other, which clearly showed that the friendliness of the method is reinforced with the repetition of each stage (TL2, VC2).

The students reacted quite pleasantly to the new way of teaching, showing a preference towards the stages of the virtual classroom and tele-cooperation.

Comparing the conventional teaching method with distance training allows us to draw some useful conclusions. First of all, we can see a balance-neutrality in the children's preference between the two methods. We can also see, however, a remarkable tendency to prefer the new method, which is getting stronger the more the interaction between the stages of the teaching methodology is intensified.

Apart from the fact that the students appear to be very attentive during the teleconference sessions, they seem to have a difficulty in assimilating the teaching of the teacher from the cooperating classroom. The gradual improvement of the children's answers during the teleconference sessions does not cancel their original impression.

Table 4
Evaluation of the teaching methodology—students' view (ONGOING EVALUATION 1,2,3,4,5)

Questions	DT1	DT2	VC1	VC2	TC
I found the new way of teaching easy to follow	4.0	4.5	3.9	4.3	4.1
I found the new way of teaching very pleasant	4.4	3.9	4.0	4.2	4.2
The new way of teaching is better than the traditional way	2.8	2.7	3.1	3.2	3.5
I found the new way of teacher's presentation easy to understand	2.6	2.7	2.8	2.9	3.0
The new way of teaching motivates me to carefully follow my teacher	3.2	3.6	3.4	3.4	3.6
I would like to participate in more courses with the new way of teaching	3.5	3.5	3.8	3.8	4.1
I would like to have all my courses with the new way of teaching	2.4	2.0	2.4	2.3	2.8

I totally agree (5), I agree (4), I don't know (3), I disagree (2), I totally disagree (1). DT1, Distance teaching—First stage; DT2, Distance teaching—second stage; VC1, Virtual school—first stage, VC2, Virtual school—second Stage. TC, Telecooperation.

The students react positively to the possibility of attending more courses at their school with the new way of teaching. This viewpoint is strengthened during the courses.

Finally, the students do not appear to have a very friendly attitude toward the scenario according to which all the courses in their school would be done with the new way of teaching. This viewpoint gets weaker as the courses continue, but the end result does not seem to markedly change.

Results: The easiness and pleasure in attending the lessons given by the teacher of the classroom is quite important, but following the teacher though a screen is not equally easy. Apparently, the sound problems in the first teleconferencing were more serious than were originally estimated. On the other hand, it appears that the students' level of attention and self-discipline during the teleconference sessions was quite high.

The students' expression of preference toward the new method compared to the conventional one is getting higher proportionately to the degree of interaction provided for by the implementation stages, but their reservations eventually prevail over any positive tendencies.

Finally, the students' preference to have a combination of teleconference sessions and conventional courses becomes apparent.

4.7. Evaluation of the social impact—students' view (ONGOING EVALUATION 1,2,3,4,5) (Table 5)

Data analysis: The new way of teaching did not affect the relations of the conventional classroom students, both with each other and with their teachers. Teleconference enabled the students get to know each other, but no special relationship and contact was developed between them. A different tendency is observed during VC2 & TC stages, where the students of one classroom show their feelings for the students of the other classroom in a more evident way.

The new way of teaching created a strong willingness among the children to get acquainted more closely, both between them and with the teacher of the other classroom.

Table 5
Evaluation of the social impact—students' view (ONGOING EVALUATION 1,2,3,4,5)

	DT1	DT2	VC1	VC2	TC
The new way of teaching gets me closer to my teacher	3.0	2.7	2.5	2.8	3.0
I feel the teacher of the other classroom that I see on the TV screen as my own teacher	2.8	2.7	3.1	3.7	3.3
The new way of teaching got me even closer to my schoolmates in the traditional classroom	2.9	2.8	2.7	2.8	3.5
The new way of teaching got me closer to the new schoolmates of the virtual classroom	4.5	4.4	4.5	4.5	4.1
I feel the pupils that I see on the TV screen as the schoolmates of my classroom	2.8	2.9	3.0	3.2	3.5
I would like to be a friend of the students that I see on the TV screen	4.1	4.0	4.1	4.1	4.3
I would like to get closely acquainted with the children and the teacher that I see on the TV screen	4.3	4.1	4.2	4.1	4.3
I prefer the traditional way of teaching	3.7	3.4	3.4	3.0	2.7
I prefer the new way of teaching	2.4	2.6	3.2	3.4	4.2
I prefer to combine the new and the traditional way of teaching	4.3	4.2	4.4	4.5	4.7
I prefer to attend the courses through a TV screen from home	1.8	1.6	1.5	1.6	1.6

I totally agree (5), I agree (4), I don't know (3), I disagree (2), I totally disagree (1). DT1, Distance teaching—first stage, DT2. Distance teaching—second stage; VC1, Virtual school—first stage; VC2, Virtual school—second stage; TC, Telecooperation.

The students reacted rather negatively towards the alternative of attending all their courses through teleconferencing. And at this point we should note that the students' disposition gets improved in proportion to the degree of interaction provided by the teaching methodology.

Although the students say in the beginning of the teleconference sessions that they are friendlier to the conventional system of teaching, their participation in teleconference sessions with a high degree of interaction impairs their original idea.

The students were quite positive toward combining the two methods—of conventional teaching and teleconference—and this viewpoint is gradually reinforced during the implementation stages. However, they continue to be totally against the scenario to have the teaching role of the school separated from its social role. It is noteworthy that their negative view on this matter is not influenced by the degree of interaction of the stage during which they are asked this question.

Results: At this stage of the evaluation, there's a remarkable differentiation in the students' answers between the implementation stages of the teaching methodology.

The second lesson during the first stage of tele-teaching seemed to tire the students, who, as a result, reacted a bit more negatively towards the new teaching method.

On the contrary, the students react in a more positive way at virtual classroom stage, where interaction between students and teachers is much more important.

At tele-cooperation stage, in particular, where interaction among the students is the focal point of the teaching methodology, the reactions of the children were even more positive.

We should also stress that the students' view about the social role of their school does not change, regardless of the stage of the teaching methodology they were asked to answer.

4.8. Final impressions (EXPOST EVALUATION) (Table 6)

We will analyse the final impressions of students in cross-correlation with their initial expectations in the next unit.

4.9. Students expectations against final impressions (EXANTE & EXPOST Evaluation) (Table 7)

Data Analysis: The communication between teacher and student through teleconference is strengthened during the program. The willingness and ability of the students of a virtual classroom

Table 6
Final impressions (EXPOST EVALUATION)

Questions	Average
I agree with the idea that I can communicate with my teacher through a TV screen	3.8
I agree with the idea that I can communicate with my schoolmates through a TV screen	4.4
I would like to attend the courses through a PC monitor	2.5
I would like to collaborate with my schoolmates through a PC monitor	4.4
I would rather attend the courses from my house through a screen, without coming to school	1.8
My school and my relation with the other children are very important to me	1.9
I met my best friends at school	4.3
The presence of my teacher in the classroom is not very important to me	1.5

I totally agree (5), I agree (4), I don't know (3), I disagree (2), I totally disagree (1).

Table 7
Students expectations against final impressions (EXANTE & EXPOST evaluation)

Questions	Exante	Expost
I agree with the idea that I can communicate with my teacher via a TV screen	3.4	3.8
I agree with the idea that I can communicate with my schoolmates via a TV screen	4.1	4.4
I would like to watch the courses through a PC monitor.	2.2	2.5
I would like to collaborate with my schoolmates through the a PC monitor	4.1	4.4
I would prefer watch the courses from my house via a screen, without coming in school	1.6	1.8
My school an the relations with the other children are very important affair for me	4.5	4.3
My best friends are from school	4.8	4.3
The presence of my teacher into the classroom is not very important for me	1.3	1.5

I totally agree (5), I agree (4), I don't know (3), I disagree (2), I totally disagree (1).

to communicate and cooperate one with another by teleconference is very strong and gets even stronger during the program. Attending courses through a computer does not seem to attract the students. The procedure of teleconference could not reverse this negative predisposition. Pupils have a much more negative attitude when they are asked to make a distinction between the social and the teaching–pedagogic role of the school, as well as when they are asked to part with the physical presence of their teachers and schoolmates

Results: As teleconferences continue, the favorable predisposition of the students towards the new teaching method is considerably improved, and especially their willingness to cooperate between them and with their teachers is getting stronger.

The utmost importance they attribute to their school, as an institution of socialization remains practically invariable. It is impressive how firmly they support the social role of the school and especially their relation with their teachers and schoolmates.

5. Conclusions and recommendations

The evaluation methodology of program ODYSSEUS focuses in three levels.

(1) The first level deals with the evaluation of technological and human resources that recommend the components parts of distance learning project: the teachers, the students and the technological infrastructure of schools.

In this section the final results are predicted. The teachers allocate the essential knowledge base and the required technological skills so that they correspond in a training environment of high requirements. The students are already familiarized with the significance of videoconference, and have an initial experience via project OIKADE. The school supports all the essential specifications concerning the required technological equipment. The teacher's technical support is proved critical factor for the smooth flow of the project.

(2) The second level is presented the evaluation of learning effectiveness of program ODYSSEUS.

The first point, in which we focus, is the monitoring ability of students to follow the new learning methodology via teleconferencing. According to the analysis of the results, the simpler the suggested methodology is, the easier it is for the students to adapt their steps into the new learning environment. On the other hand the more interactive courses we implemented, the more

it caught the student's interest. At this point we find out a weak side of our methodology. In the future efforts, we will emphasize in informing the students on the new way of learning methodology before the start of the program, using real examples into the classrooms.

The second point is related on the student effectiveness. The student's facility in the understanding of the content, the attention that demonstrate and the pleasure from the follow-up of the new learning methodology, are important factors that influence the student's effectiveness of learning via teleconferencing. The students that participated in the ODYSSEUS program connect their learning effectiveness with the interaction caused by the various phases of methodology that were followed. Carrying the rules and principles that govern conventional teaching over to the new distance learning process, the students did not meet the method with the expected response. So we have to focus on an alternative point of view: the training modules need to be further enriched, the teaching methodology needs to introduce more innovations, concepts and methodologies (e.g. educational multimedia, co-operative learning) and most importantly, those stages allowing for more interaction should be reinforced.

The third point presents student descriptions of the courses in the near future, comparing the conventional with the distance-learning model. The answers of participating students confirm the opinion that the new learning environment should constitute the combination of the new educational technologies and traditional pedagogic approaches.

(3) In the third level, we focus on the social implications of the suggested distance learning model. Examining the relations that are created among the students of the virtual classroom, we realize that communication via videoconferencing cannot fully replace real face-to-face communication. The phase of tele-cooperation offers intense interaction, which improves the communication conditions, but does not substitute the feeling of personal and physical contact among the students of the virtual classroom.

During the videoconferences the students are familiarized step-by-step with the teacher that they see from their TV monitors, but the virtual teacher does not replace their own teacher (of the real classroom).

Finally the results confirm that the traditional school environment (with the courtyard games) is a factor of significant importance with regard to socialization of children as an absolutely necessary component part of student's everyday school lives.

6. Future research

The pilot stage of the ODYSSEUS program was completed in December 2001. On 6 December 2001, the Ministry of Education and Culture of Cyprus, the Department of Computer Science of the University Cyprus and the Bank of Cyprus signed a 3-year memorandum of collaboration that stipulates the continuation and extension of the program in Greece and for the Greeks of America, Australia, etc. The experience gotten during the pilot stage, and particularly the results of the evaluation that are published in this work, constitute the most important elements for the support of our efforts and the optimization of our results.

Future endeavors will be focused on the improvement of the teaching and evaluation methodology, on the interactive implementation of teaching modules, on the intensification of the social dimension of distance learning and, finally, on a more efficient utilization of new educational

technologies. In the year 2002, we implemented the ODYSSEUS methodology in four elementary schools of Cyprus, located in Nicosia, Limassol, Larnaka and Paphos.

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Dr Panagiotis Anastasiades was born in 1966 at Kalllithea, Athens. He has graduated from the Department of Informatics of the Athens University of Economics and Business (ASOEE) in 1990. He has worked for a series of years in the private sector and particularly in the financial economics and insurance sectors.

He took graduate studies at the Panteion University of Social and Political Sciences, Department of Psychology, (PhD 1999, thesis: *The information society—a socio-psychological approach*) His thesis was approved with an excellent grading.

At the end of 1999, he received a government scholarship by the State Foundation of Scholarships (IKY), in order to undertake his postdoctoral research under the title: ''The new model of employment in the emerging digital economy'', while the Department of Economic and Regional Development of Panteion University is appointed as his scientific supervisor.

He has been developing an intense research activity in the frame of European programmes and initiatives (race stratospheric), whilst at the same time he has been practising his lecturing duties in Undergraduate and Postgraduate Programmes of study in the Higher Education System of Greece (Panteion University, SELETE etc). Moreover, he has been participating in seminars sponsored by the European Union and European Social Fund (Euro qualification, etc.)

Since 1995 he has belonged to the scientific body of the National-Greek-Observatory of Employment, whilst in 1997 he was placed in the National Supporting Body of the Ministry of Employment and Social Security in the frames of Social Initiative (ADAPT—BIS, Building the Information Society).

At the beginning of 1999, he published his first book with the title: ''*The European Information Society—The need for the existence of a unified regulatory and legislative framework*'', while at the same time he was selected by the Pedagogical Institute and the Ministry of Education as one of the authors of a textbook for secondary education, with the title: ''*The Information Society*''.

In October 2000, he presented his second book under the title: ''*Information Age*'' published by Nea Synora, A. Livani, Athens. This book aims to familiarize the reader with the new electronic reality as it is been formed in the emerging digital society. The book includes a preface by the Dean of the University of Patras, Professor Stamatis N. Alachiotis. Since September 2000, has been Visiting Lecturer in the Department of Computer Science in the University of Cyprus. He is currently Assistant Professor in the Department of Primary Education at the Polytechnic School of the University of Crete.

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