



Interactive Videoconferencing for collaborative learning at a distance in the school of 21st century: A case study in elementary schools in Greece

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ABSTRACT

The aim of this paper is to present the design, implementation and evaluation of the methodology which focuses on the pedagogical utilization of Interactive Videoconferencing (IVC) in the contemporary elementary school.

As part of the project “ODYSSEAS”, during the school year 2007–2008, 46 students and 4 teachers from two elementary schools in Athens and Crete collaborated at a distance via IVC and, with the aid of the animation technique, designed and implemented constructive activities on the topic: “Environment–Climatic Changes”.

According to the findings of this paper, IVC under pedagogical conditions plays a significant role in supporting collaborative synchronous learning activities at a distance by strengthening the social relations among students and teachers of the local and the remote class at both schools. This survey brought to light that the combination of IVC and face-to-face learning activities consolidates the role of the modern school as a socialization agent. At the same time, it broadens students’ opportunities for communication, collaboration and expression by strengthening their willingness to make new contacts all over the world.

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1. Introduction

Worldwide, there has been noticed a gap between the knowledge and skills provided by the educational system and the new needs resulting from the Knowledge Society (Adler, 1999; Autor, Levy, & Murane, 2000). The various educational systems, through the new curricula and methods, emphasize the collaborative construction of knowledge and the cross-curricular approach so that they link school with authentic real-life situations. Within an open student-centred environment, the emphasis is laid on the development of vital cognitive, social and technical skills, aiming at the preparation of future citizens for their creative and critical integration into the emerging Knowledge Society of the 21st century (Anastasiades, 2009).

Information and Communication Technologies (ICT) and especially Advanced learning technologies of synchronous transmission can effectively support the educational uses of Video Conferencing features by providing innovative learning and instructional strategies that would improve communication, collaboration and interaction between the learner and the educator (Hinger, 2007; Kerrey & Isakson, 2001; Latchem, 2002; Saw et al., 2008; Sideridis, Papadopoulos, Voulgari, & Houssou, 2007). The term Video Conferencing (VC) refers to the communication in real time via audio, live video and data between two or more distant locations (Alexander, Higgison, & Mogey, 1999; Chandler & Hanrahan, 2000; Gibson & Cohen, 2003; Reed & Woodruff, 1995; Suthers, 2001).

Interactive Videoconference (IVC), under pedagogical and social conditions is an effective tool for the contemporary instructor, as it can contribute to the opening up of the class to new communities and the familiarization of students with new learning and cultural experiences and alternative-innovative learning approaches (Anastasiades, 2009). IVC requires the students’ real time physical presence to communicate with learners at distance sites (Newman, 2008).

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According to Anastasiades (2009) seven types of IVC in K-12 Instruction are frequently found:

1. *Experts and lectures*: The objective of this practice is to allow students and educators to be introduced into new ideas and innovations by distinguished experts (scientists, artists, literati, etc.) in order to raise awareness of students on a number of issues (Barbanell, Falco, & Newman, 2003; Edens, 2001; McCombs, Ufnar, & Shepherd, 2007).
2. *Virtualfield trips*: Offer a class the opportunity to tour a place without commuting (Pachnowski, 2002; Woerner, 1999). A VFT consists a "communication and cultural bridge" for students and schools worldwide regardless of their geographical location (Ashton, 2002; Harkess, Kuehny, Evans, Greer, and Cavins, 2007; Stainfield, Fisher, Ford, & Solem, 2000).
3. *Connecting schools (participation events)*: The IVC offers two or more schools the opportunity to co-organize events regardless of their geographical location, aiming at the consolidation of relationships and the exchange of cultural and social concepts (King & Kullman, 2007, Newman et al., 2005; Cole, Ray, & Zanetis, 2004; Drescher, Hyjek, Campbell, Biggam, & Jones, 2005),
4. *Instructional activities at distance*: Through the IVC two or more classes have the opportunity to communicate so that teachers and students share educational techniques, innovative ideas and instructional methodology, etc. (Anastasiades, 2003; Gage, Nickson, & Beardon, 2002; Martin, 2005; Yost, 2001).
5. *Virtual Collaborative Classroom* (cross-curricular thematic approach): The IVC offers two or more schools the opportunity to create, under pedagogical conditions, an environment for collaborative structure of knowledge at distance (Virtual Collaborative Classroom), aiming at the open-up of school towards wider social and cultural environments (Anastasiades, 2003, 2007, 2009; Bidjerano & Wilkinson, 2008; Ertl, Fischer, & Mandl, 2006; Howland & Wedman, 2003; King & Macklam, 2007).
6. *Distant locations and disabilities (homebound videoconferencing)*: This VC type covers mostly students at distant locations or students with disabilities (Bello, Knowlton, & Chaffin, 2007; Newman, 2008).
7. *Teachers training and administration collaborative activities at distance*: IVC can significantly facilitate teachers' access to training programs and administrative activities regardless of their geographical location (Anastasiades, 2008; Basham, Lowrey, Jones, & Huffman, 2006; Kullman & King, 2007; Stewart & Vallance, 2008).

IVC nowadays plays a significant role in supporting collaborative synchronous distance learning activities (Anastasiades, 2007; Gerstein, 2000; Greenberg, 2006; Newman, 2008), promoting interaction in the classroom (Cavanaugh, 2001; Sherry, 1996) as a critical factor to any videoconferencing-based learning situation (Amirian, 2003).

Although VC provides participants with the ability to watch, hear and communicate with each other simultaneously, the interaction among the persons is more impersonal than in a conventional "face-to-face" teaching process (Bonk, Malikowski, Angeli, & Supplee, 1998; Collins, 1991; Schweizer, Paechter, & Weidenmann, 2003). Participants do not share the same three-dimensional space, as they can watch only what the camera shows. Furthermore, the non verbal contact among them is usually vague (Bruce, 1996).

If one believes that VC is like a conventional "face-to-face instruction", they will be disappointed (Anastasiades, 2009; Hearnshaw, 1998). The first studies, which were conducted by evaluating the effectiveness of the educational use of VC, indicated that it has not yet met the participant's expectations (Delaney, Jacob, Iedema, Winters, & Barton, 2004; Knipe & Lee, 2002; Motamedi, 2001). According to Ferran and Watts (2008), adult attendees of videoconferences must work harder to interpret information delivered during a conference than they would if they attended face-to-face. Furthermore videoconference presenters can use heuristic cues to increase the influence of their message (Ferran & Watts, 2008). Hearnshaw (1998) claimed that VC is considered to be beneficial to support dialogue, but may not be appropriate for decision making (Ferran & Watts, 2008). However, VC may not be the optimum choice for independent learning focused primarily on content delivery.

According to Anderson (2008), VC offers high levels of immediacy and social presence and, therefore, can play an important role in the networked distance education tool set. On the other hand, it is no panacea and competes unfairly with perceptions and expectations of classroom delivery. As a stand-alone system, VC does not provide the level of student engagement with teachers, other students or content, which is needed to sustain their attention, enthusiasm and ultimately high levels of learning. The place for VC in distance education is that of one of many networked tools.

Conclusively, technology alone is not sufficient and thus, there is a demand for a holistic pedagogical framework on the development and implementation of synchronous collaborative learning environments at distance via VC (Amirian, 2003; Anastasiades, 2009; Gibbs & Gosper, 2006; Greenberg, 2004; Reeves, 1997). As Clark, (2000) mentioned, it is the application, design, and ways that the technology is used that determines its educational value – not the simple acquisition or use of the technology.

ICTs should embrace a general cultural and social framework (Lionarakis, 2006; Makrakis, 2000; Raptis, 2004). The dynamic and creative corporation of ICTs in a general social framework (Carr & Kemmis, 2002) and the use of technology under pedagogical conditions could encourage the development of interactive learning environments at distance, which would provide learners with the ability to use their mental schema creatively and critically (Brusilovsky, 1999; De Bra, Eklund, Kobsa, Brusilovsky, & Hall, 1999; Kostoula & Makrakis, 2006), and develop their own conditions so that they will become receptive to all forms of distance learning (Lionarakis, 1998, 2005).

Although the application of VC in schools is significantly increasing (Newman, 2008), there is obviously a lack of pedagogical design in the educational VC projects. The major contribution of this paper is to present the pedagogical framework which should be combined with IVC in order to support teachers and students to design and implement a Virtual Collaborative Classroom according to their learning needs within the social and cultural environment.

The proposed pedagogical framework is the outcome of the significant experience acquired from the project "ODYSSEAS", which has successfully completed 8 years in operation and so far, approximately 900 students and 45 teachers from 16 elementary schools have participated in 78 educational videoconferences (Anastasiades, 2003, 2006, 2009). The bodies responsible for the implementation of the project "ODYSSEAS" are the Department of Primary Education and the Institute of Elementary Teachers Training of the University of Crete (<http://www.edc.uoc.gr/~odysseas/>).

The aim of this paper is to present the methodology which focuses on the pedagogical design of IVC in two elementary schools in Greece, which lays emphasis on the critical issue of the protection of the environment focusing on the climatic changes. The main objective is to engage students in genuine learning situations with the view to raising awareness of environmental issues as well as encouraging initiative for group action via collaborative activities at a distance.

The structure of this paper is as follows:

- In the second part we present the theoretical framework of the pedagogical utilization of IVC in elementary school, emphasizing on the development of cognitive, social and technological skills which are essential for the citizen of 21st century. Also, we analyze the methodology of the instructional design of interactive VC, focusing on the collaborative structure of knowledge, cross-curricular approach and exploratory learning.
- The third part deals mostly with the methodology of script writing (specially adapted for the needs of elementary students) by means of the animation technique.
- In the fourth part, we present in detail the stages of VCs, the ways in which the students collaborated at a distance in order to design and create scripts and short films using the animation technique.
- Finally, in the fifth part we present the implementation of instruction and in the sixth part we present the evaluation of this instructional approach according to the appropriate evaluation methodology.

2. Designing Interactive Videoconferencing (IVC): the theoretical framework

2.1. The basic principles

The suggested Pedagogical model is based on:

1. *The principles of cross-curricular thematic approach.* The promotion of cross-curricular thematic approaches through the contemporary learning theories is the result of the recent transition from the philosophical consideration of determinism, Carteius perception of things and technological determinism to the new reality of inter-disciplinary approaches, Gestalt psychology and social transformation (Beane, 1997; Matsagouras, 2002).
2. *The socio-cultural and constructivism theory.* The specific theory can serve cross-curricular thematic schemas of learning approaches (Matsagouras, 2002: 37). The Theory of Situated Learning maintains that learning is achieved through the learners' active participation in "communities of practice" or "learning communities" and it results from the interaction between the activity and the social-cultural context in which it occurs (Lave, 1997; Lave & Wenger, 1991; Wenger, 1998; Wenger & Snyder, 2000). The development of social and cognitive skills can be promoted through the approach of cognitive apprenticeships (Brown, Collins, & Duguid, 1989; Vosniadou, 2002).
3. *The project method.* The connection of our instructional approaches with the students' interests and planned collaborative action in the spectrum of cross-curricular thematic approaches can be supported by the project method (Matsagouras, 2002). The Project Method encourages the development of interactive learning environments, which support collaborative learning through critical thinking, discovery learning (Bruner, 1966), and the learner's involvement in authentic situations. As a result, it enhances the development of student's personality and self-initiated action on the basis of a holistic approach of knowledge (Knoll, 1997; Maxim, 1999).
4. *The American distance education consortium principles.* The proposed methodology adopts the ADEC guiding principles for distance teaching and learning (ADEC Guiding Principles for Distance Learning, 1999).

2.2. Pedagogical design

The organization of a successful VC requires detailed design and preparation, as there are a number of factors to take into consideration. Depending on the VC type, the participants' needs and the set goals we should investigate aspects such as the necessary technological equipment, the lay-out of venues, the organizational arrangements and, last but not least, the conditions for a warm and collaborative environment for the participants (Anastasiades, 2009).

The most important phase of the proposed methodology is the pedagogical design (Fig. 1), which consists of five stages: the instructional design, the technological design, the financial planning, the administrative structure and the evaluation methodology.

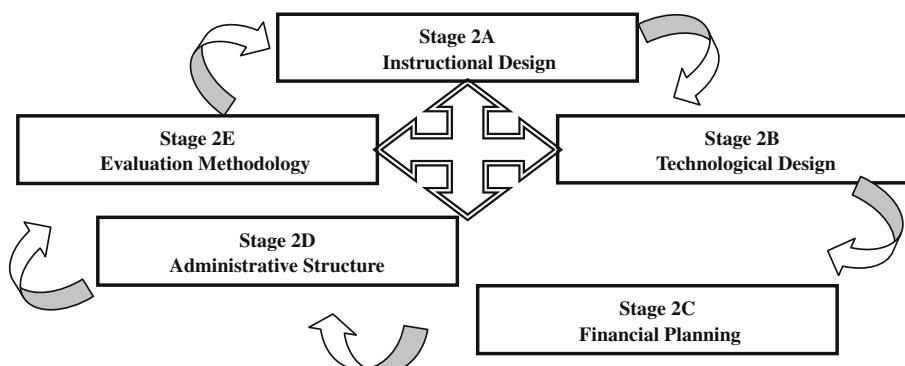


Fig. 1. The levels of Pedagogical design (Anastasiades, 2009).

- *Stage A: Instructional design*

The instructional design is decisive for the implementation of the selected solution so that our learning objectives are served according to the requirements and restrictions recorded during the first phase of needs analysis, concerning the technological, financial and administrative aspect.

The stage of instructional design includes seven actions:

- Action 1: Specification of venues.
- Action 2: Teachers' training.
- Action 3: Specification of the topic.
- Action 4: Selection of the interaction model.
- Action 5: Lesson planning (IVC Pyramid).
- Action 6: Preparing the students and their parents.
- Action 7: Definition of the time-schedule.

Numbered actions of Stage A are presented with explanation and in Section 4.2.1.

- *Stage B: Technological and class design*

The stage of technological design includes six actions:

- Action 1: Architectural design of the class.
- Action 2: Technological design of the class.
- Action 3: Specification of the videoconference system characteristics.
- Action 4: Specification of the communication infrastructure.
- Action 5: Specification of the additional required technology (screens, projectors, etc.) and software.
- Action 6: Specification of the required complementary equipment (furniture, etc.)

Numbered actions of Stage B are presented with explanation and in Section 4.2.2.

- *Stage C: Financial planning*

At this stage, the following actions are recommended:

- Action 1: Drawing up the budget and time-schedule.
- Action 2: Finalization of the procedure for the supplies, purchase, installation, service.
- Action 3: Selection of the most convenient solutions

Numbered actions of Stage C are presented with explanation and in Section 4.2.3.

- *Stage D: Administrative–organizing structure*

This stage includes the following actions:

- Action 1: Drawing of an organization chart governing the participants' relations.
- Action 2: Formation of a monitoring board.
- Action 3: Formation of an educational organizing board

Numbered actions of Stage D are presented with explanation and in Section 4.2.4.

- *Stage E: Evaluation methodology*

The evaluation methodology proposed as part of the "ODYSSEAS" project follows a procedure of 11 steps (Anastasiades, 2003, 2009) and is presented in Section 4.2.5.

3. The methodology of script writing using the animation technique (specially designed for the needs of elementary students)

The suggested methodology of script writing using the animation technique in the instructional process (Siakas, 2008) contributes greatly to the achievement of the instructional and learning objectives, so that students create audio-visual material focusing on cross-curricular activities of knowledge structure.

The specific methodology is the outcome of combining script writing processes (Bordwell, 1985; Bordwell & Thompson, 2005; Branigan, 1992) and animation methods (Halas & Manvell, 1969; Laybourne, 1998) in workshops within the context of the curriculum of Environmental Education and Language in elementary level.

The instructional practice of workshops was based on the pedagogical approach which aims at active learning and cognitive autonomy of the student and is manifested mostly in the Constructivism theory (Piaget, 1966; Vygotsky, 1978) and discovery learning (Bruner, 1966).

According to Bordwell and Thompson (2005), each script is comprised of two elements: (a) the “story”, which is a sequence of events and (b) the “plot”, namely only the facts presented in the audio-visual material, enriched with other features (sound, music background, narratives, etc.).

As for the relationship between the story and the plot, we can say that: (a) the chronological order of events in the story can be different from the presentation in the plot and (b) a number of the story events can be omitted, depending on the scriptwriter’s choice.

4. From theory to practice: the stages of Virtual Collaborative Classroom

4.1. General description

As part of the “ODYSSEAS” project during the school year 2007–2008 the Leontio Elementary School of Athens and the Elementary School of the naval yard in Chania (Crete) designed and implemented distant collaborative activities of cross-curricular form. This was achieved via VC in the Module: “Environment–Climatic changes”. The general objective of the suggested instruction was to raise awareness of students on environmental issues, and particularly the issue of climatic changes of the planet, through exploration, critical and creative thinking, so that they develop essential cognitive, social and technological skills. According to the recommended methodology (Anastasiades, 2009), students collaborate at distance via VC and, by implementing the script writing methodology (Siakas, 2008), they create their own audio-visual material using the animation technique.

4.2. Pedagogical design

4.2.1. Instructional design (Stage A)

4.2.1.1. Action 1: specification of venues. With the aid of the Department of Education of the University of Crete, the two participating schools were selected, the Leontio Elementary School of Athens and the Elementary School of the naval yard in Chania (Crete) (Fig. 2). The participants in the project were 46 students and 4 teachers.

4.2.1.2. Action 2: teachers’ training. The teachers from both schools were already experienced in designing educational VCs, as they had participated in the “ODYSSEAS” project for 2 years. However, they attended a training seminar in Athens, so that they were familiarized with the methodology of script writing and animation technique.

4.2.1.3. Action 3: specification of the topic. After comprehensive discussion, teachers and pupils decided to elaborate on the subject of Environment and Climatic changes. It is an issue affecting everyday life worldwide, which has increasingly been promoted and concerns greatly the younger generations.

4.2.1.4. Action 4: definition of the time-schedule. At this stage we design the activities which are integrated in a strict time-schedule of implementation (Fig. 3).

4.2.1.5. Action 5: selection of the interaction model. According to the suggested methodology, we implement Model A of the University of Maryland University College, USA (IDE, 1996) (Fig. 4 and Snapshot 1).

4.2.1.6. Action 6: lesson planning (the IVC Pyramid). The students were gradually introduced to the new instructional approach in order to be smoothly familiarized with the new learning environment. This was achieved through the IVC pyramid (Fig. 5) according to the suggested methodology (Anastasiades, 2003, 2007, 2009).

4.2.2. Technological and class design (Stage B)

4.2.2.1. Action 1: architectural design of class. In the architectural design of class we should consider three fundamental conditions:

1. The Classroom layout should allow and enable the development of group collaborative activities and be adjustable according to the VC needs.
2. The layout presented in Fig. 6 and Snapshot 2 has taken into account that there are two different groups of audience:



Fig. 2. The participating schools.

Set of Actions*	2008											
	1	2	3	4	5	6	7	8	9	10	11	12
A												
B												
Γ												
Δ												
E												

* Set A: Preparatory stage – Action planning Set D: Design of audiovisual material – presentations etc.
 Set B: Implementation of actions Set E: Dissemination Set C: Proceeding evaluation data

Fig. 3. Time-schedule.

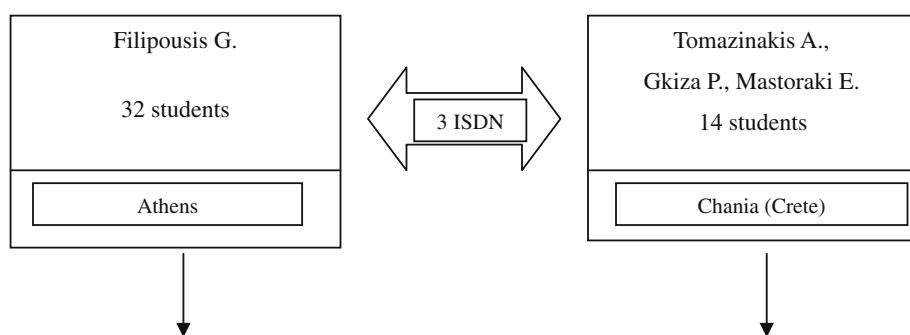


Fig. 4. The interaction model.



Snapshot 1. From theory to practice.

- Audience A, comprised of the students collaborating with the ones of the remote class (intergroup audience).
- Audience B (B1 + B2), comprised of the students collaborating with each other in the local class (intragroup audience).

We should point out that the students take turns in groups B and A according to the assigned roles and duties.

3. The camera should be placed above the Monitor as it is easier for the teacher and students to be actively engaged in the VC.

4.2.2.2. Action 2–Action 6. In order to organize a successful VC, we should ensure that there are the necessary technical requirements – audio, image, data sharing, additional equipment – as well as the necessary communication infrastructure – connection speeds, available bandwidth, etc. (Anastasiades, 2009). The technological model of Leontio School includes 1 ISDN connection and a set top VC system with wireless microphones. The school of Chania (Crete) uses the VC room of the Department of Elementary Education of the University of Crete, which provides all the necessary technical equipment (Anastasiades, 2009).

4.2.3. Financial planning (Stage C)

According to “ODYSSEAS” approach the drawn up budget was carried out according to the collaboration memorandum. The cost of technological infrastructure of Leontio School in Athens was approximately 5.000 euros.

4.2.4. Administrative–organizing structure (Stage D)

In accordance with “ODYSSEAS” methodology (Anastasiades, 2003, 2009) the organization was the following:

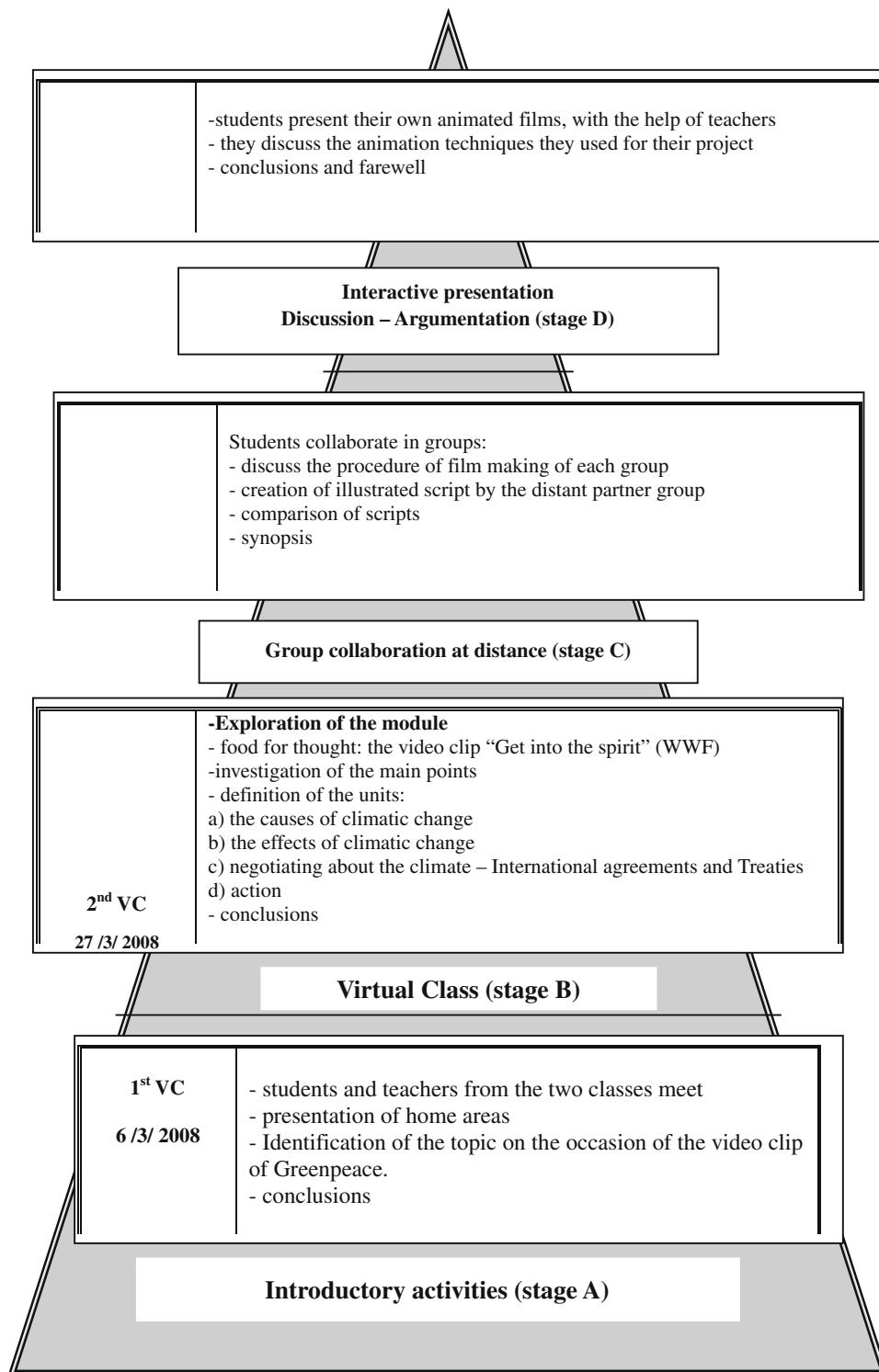


Fig. 5. The IVC Pyramid (Anastasiades, 2003, 2007, 2009).

- **Scientific Head:** Anastasiades Panagiotes, Assistant Professor University of Crete-Department of Education
- **Scientific Counsellor** (in charge of script writing methodology and animation technique): Siakas Spyros, PhD student of Hellenic Open University.
- **Design and implementation team:** Their task was to plan instruction, schedule and implement the projects. Members of the team: Anastasiades P. (Scientific Head), Siakas Spyros (Scientific Counsellor), Filipousis G. (Teacher of Leontio School, Athens), Tomazinakis A., Gkiza P., Mastoraki E. (teachers in the elementary School of Chania, Crete).
- **Support Team:** Karvounis L. (Administrative Head, PhD student in the University of Crete), Kotronis D. (teacher), Gkoka A. (undergraduate student), Aposkitis C. (Technical support).

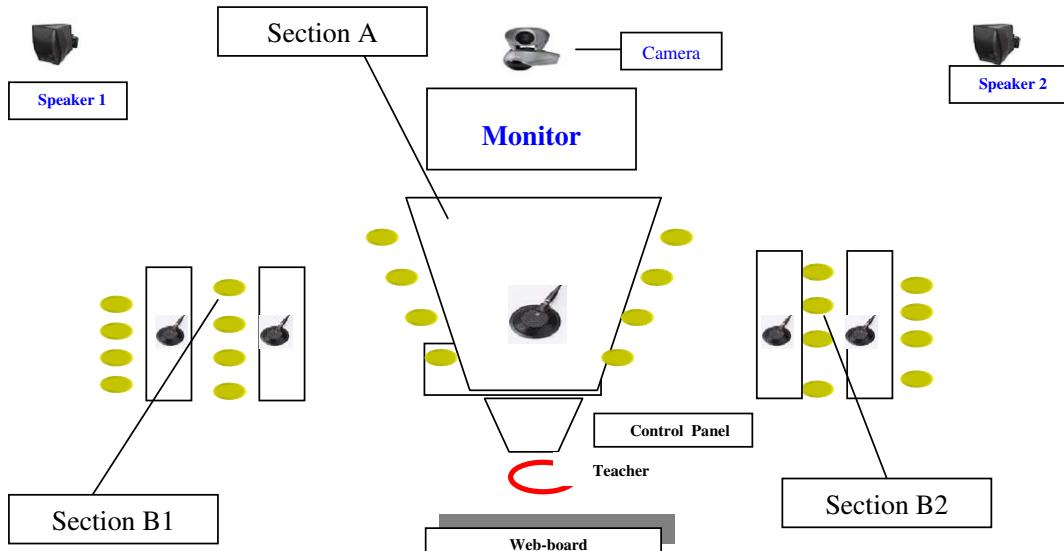


Fig. 6. The layout of the VC classroom (Anastasiades, 2003, 2009).



Snapshot 2. From theory to practice: The layout of the VC classroom.

4.2.5. Evaluation methodology (Stage E)

The elaboration of an evaluation methodology for IVC is one of its most important components. It is a decisive factor in revealing certain weak points in the teaching and the pedagogical methodology during the piloting stage. At the same time this can shed light on previously unknown instructional and social aspects of our endeavour.

The evaluation of the proposed instruction, which was part of the ODYSSEAS project, was based on:

- The naturalistic evaluation model, according to which evaluation is conducted in the same setting of the instruction and with the collaboration of the participant students and teachers (Guba & Lincoln, 1981).
- The evaluation post-model of Owens (2002), which focuses on five aspects of evaluation: ex ante evaluation (before the instruction), on going evaluation (during the instruction), ex post evaluation (after the instruction), evaluation of the structure and interactive evaluation (improvement of development and structure emphasizing on the innovative activities).

In conclusion, the suggested evaluation is an applied synchronized field survey, which combines qualitative (interviews, reports, semi-structured observation charts by non-participant reviewers, diaries, etc.) and quantitative (questionnaires, etc.) evaluation methods.

The evaluation methodology proposed as part of the “ODYSSEAS” project follows a procedure of 11 steps (Anastasiades, 2003, 2009) which are the following Table 1 and Fig. 7.

In this paper we present an applied quantitative synchronized field survey to investigate the students’ views on four fundamental queries which are detailed described in Section 6.

5. Implementation of instruction

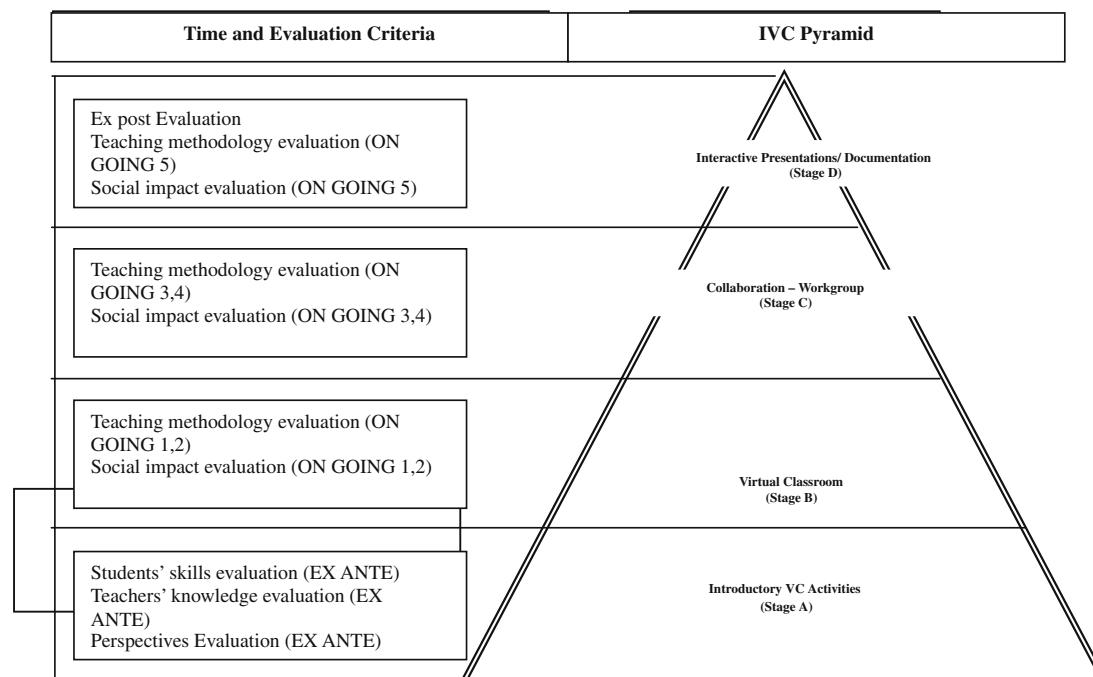
5.1. Preparation of the 1st VC

Students from both schools collaborated in groups in order to present their home areas. They gathered information (texts, pictures and video) on the Internet, focusing on the validity and seasonality of it. They classified the information in thematic categories, decided which to use and processed it on Photoshop software. This material was used in their PowerPoint presentations.

Table 1

The 11 steps of "ODYSSEAS" evaluation methodology (Anastasiades 2003, 2008).

Evaluation steps (actions)	Description
1. Evaluation target	Improvement of the instructional design Improvement of the social interaction Improvement of the technological infrastructure Improvement of the administrative design
2. Object of the evaluation (definition of the evaluation's scope)	Evaluation of instructional design Evaluation of the potential social impact Evaluation of the technological design Evaluation of the administrative design
3. Subject of the evaluation (who gets evaluated)	Students/teachers/technological Infrastructure
4. Evaluation performers (who evaluates)	Students/teachers/support team/research team
5. Safeguards of the evaluation	Development of techniques to secure the reliability of the results
6. Evaluation criteria	Evaluation of the instructional design by the students and teachers Evaluation of the social impact by the students and the teachers Evaluation of the technological design by the students and teachers Evaluation of students' learning effectiveness and satisfaction Evaluation of teachers' satisfaction
7. Evaluation against time	Ex ante/on going/ex post
8. Evaluation tools	Triangulation methodology (Cohen & Manion, 1994) Students' questionnaires (exante, ongoing, expost) Students' reports (exante, expost) Students' group interviews (video encoding) Teachers' semi-structured interviews (exante, expost) Observation forms from the support and research team IVC Video encoding (on going) Diary (on going) Quality–quantity analysis
9. Data collection–data analysis	SPSS 11–14 Lickert scale (absolutely disagree–absolutely agree 1–5) Exante/expost evaluation: the averages were compared via t-test, with statistical importance $p < 0.05$ On going 1–4 evaluation: the averages were compared via ANOVA, with statistical importance $p < 0.05$
10. Presentation of results	Structured reports Homogenized charts Suggestions for improvement actions
11. Utilization of results	Immediate Ex post

**Fig. 7.** The relation between the teaching methodology, evaluation against time and evaluation criteria (Anastasiades, 2009).

The teachers showed an animated video, produced by students of other elementary schools, so that the students were familiarized with this technique.

5.2. Activities in the 1st VC (duration: 60')

The objective of the 1st VC was to allow students to meet each other and identify the main topic (module). After the welcome greetings from the Headmasters and teachers, the students made PowerPoint presentations of their home town and school. Following, there was a first discussion and the VC was concluded with the promotion of the module "Climatic changes", which was conducted via a video clip of Greenpeace, presenting climatic change (<http://www.youtube.com/watch?v=vgvnqv1-D4>). The students answered specific questions and discussed to decide on the topic. The 1st VC ended with a brief summary.

5.3. Activities between 1st and 2nd VCs

The students searched for information about climatic changes in books, magazines and websites. According to the methodology of script writing (Siakas, 2008), the information was classified in thematic categories and source (photographs, illustrations, articles, tales, etc.).

5.4. Activities in the 2nd VC (Duration: 60')

The objective of the 2nd VC was to investigate the topic and identify the sub-units. As food for thought, students watched the video clip "Get into the spirit", which WWF (the world's leading environmental organisation-www.wwf.org) produced to raise awareness of the public on the issue of climatic changes (http://www.youtube.com/watch?v=9l5flq3-A_4). Then, the students elaborated, individually and in groups, on the meaning of the lyrics, by filling out a working sheet.

The activities were designed to support and encourage students to further investigate the topic. After discussion, they decide on the following units:

- (a) the causes of climatic change
- (b) the effects of climatic change
- (c) negotiating about the climate – international agreements and treaties
- (d) action

The 2nd VC was concluded with a brief summary of the thematic units and the course of action to be followed.

5.5. Activities between 2nd and 3rd VCs

The students were divided into groups and assigned different units. According to the methodology of script writing in the educational process (Siakas, 2008), they decided on the viewpoint from which they would present the gathered information (which character's viewpoint) and composed the suitable text (dialogues and monologues). Following, they developed their idea into a synopsis, illustrated script and Flip book and prepared a PowerPoint presentation of the above.

5.6. Activities in the 3rd VC (duration: 60')

The objective was for students to collaborate at distance, so that they start developing the illustrated script. Based on the thematic units, the students worked in four groups.

The students from Athens presented their unit, synopsis, the course of their work to create the script, their sketches and the techniques they used (illustrated script and Flip book).

The students from Chania presented only their synopsis of the story and asked their distant partners to imagine the form and structure of the story and present it in a model illustrated script in A3 paper. The students from Athens did so and showed their illustrated script to their distant partners. Following, there was discussion comparing the two scripts.

5.7. Activities between 3rd and 4th VCs

On April 18th the students from Chania (Crete) visited the Leontio School in Athens. The Athenian children welcomed the Cretans in a classroom decorated with pictures and plasticine sculptures representing the connection between the two cities: the main idea was that distance had been eliminated thanks to new technologies. They exchanged views, had fun and took photographs together. The teachers from both schools gave out T-shirts with the "ODYSSEAS" logo and then, students played football in the school field. Concluding the visit, children said good-bye and wished that the students from Athens would soon visit Crete.

After the visit, students were allocated 15 days' time to realize their script in audiovisual form using the animation technique and the resources available at their school (digital cameras, PCs). In particular, they recorded their scripts based on the texts they had composed, created the model characters with various materials (plasticine, cartons, collages, etc.) and took photographs of them according to the suggested methodology. This way they created a sequence of photographs, which, in motion, gave the animation result. Teachers synchronized the audio and visual parts according to the illustrated scripts of the students and created one film for each thematic unit.

5.8. Activities in the 4th VC (Duration: 80')

The objective of the 4th VC was for the students to present their work and discuss it. Each group had undertaken the task to present their film. The presentation was through projection of the animated films, which had been created by video recording frames of the characters made of plasticine (Snapshot 3), drama (Snapshot 4), cans, boxes and other objects (Snapshot 5).



Snapshot 3. Animated films of the students, created by taking photographs of characters made of plasticine.



Snapshot 4. Animated films of the students, created by taking photographs of drama play.



Snapshot 5. Animated films of the students, created by taking photographs of objects made by themselves.



Snapshot 6. Discussion between the two classes.

After the presentation of the films, the students explained their course of work and collaboration and the difficulties they encountered (**Snapshot 6**).

On the occasion of the animated films, the students discussed in order to draw joint conclusions about the climatic changes and the confrontation of the problem. Finally, a closing ceremony was organized, where they sang and exposed their views by means of the animation technique. They said farewell and wished each other a good summer.

5.9. Activities following the completion of VCs

The environmental organization WWF visited the students in Athens and discussed with them the issue of climatic changes and the activities they had realized via VC in the “ODYSSEAS” project. All the students’ activities were posted in the WWF website. On June 6th, 2008 there was a celebration for the closing of the project, in which students presented their work and were awarded honorary certificates.

6. Evaluation

6.1. General description

The survey was based on the evaluation methodology of “ODYSSEAS” (Anastasiades, 2003, 2009). The primary objective of the survey was to investigate the students’ views on:

- (a) The communication/interaction with their teachers via VC.
- (b) The collaboration with the distant partners via VC.
- (c) The possibility of replacing face-to-face instruction with home schooling via VC.
- (d) The function of school as a socialization agent.
- (e) To what extent their participation in the VCs influenced their original views.

6.2. The queries

There were four fundamental queries:

1. How do students feel about the possibility of communicating and interacting with their teacher via VC? Were their original views influenced by their participation in the VCs and to what extent?
2. How do students feel about the possibility of communicating and collaborating with students of a distant class via VC? Were their original views influenced by their participation in the VCs and to what extent?
3. What were the students' views on the possibility of replacing face-to-face instruction with home schooling via VC? Did their participation in the VCs influence their stance and to what extent?
4. Is VC a factor that influences students when considering school as a socialization agent and to what extent?

6.3. The survey methodology

- **Time:** The survey was conducted from January to May 2008.
- **Survey method:** It was an applied quantitative synchronized field survey.
- **Data collection:** Six questionnaires with closed questions were used in two phases. In the first phase, we collected the ex ante (before the VCs) and ex post (after the VCs) evaluation. In the second phase ONGOING questioners 1–4 were collected.
- **The survey sample:** 46 6th grade students participated from both schools in Athens and Chania (Crete).

Table 2 presents the profile of the sample:

We see that 14 of the students were from the Elementary school of Chania (Crete) and 32 from the Leontio Elementary school of Athens. From the 28 boys, 8 were in Chania (Crete) and 20 in Athens and from the 18 girls, 6 were in Chania (Crete) and 12 in Athens.

- **Data analysis:** The statistical analysis of the data was conveyed with the software SPSS 16.0 for Windows in two phases:
 - In the first phase, we compared the ex ante and ex post evaluation. Students' views were coded in Likert scale (absolutely disagree–absolutely agree 1–5) and the averages were calculated for each question of both ex ante and ex post evaluation. The averages were compared via *t*-test, with statistical importance $p < 0.05$.
 - In the second phase, ONGOING evaluation 1–4 was applied. Students' views were coded in Likert scale (absolutely disagree–absolutely agree 1–5) and the averages were calculated for each question. The averages were compared via ANOVA, with statistical importance $p < 0.05$.

Reliability was quantified by measuring internal consistency using Cronbach's alpha coefficient (Cronbach, 1951). The ex ante questionnaire has an accepted reliability, with a Cronbach's alpha of 0.74. The Expost questionnaire has also an accepted reliability, with a Cronbach's alpha of 0.81.

6.4. Presentation and interpretation of survey results

In the tables below we briefly present the views of the students who participated in the VCs and the analysis of data (see Tables 3–12).

6.4.1. First phase: comparison of ex ante and ex post evaluation

Based on the suggested methodology for the introduction of VC in class, we present below the results of the comparison between the ex ante and ex post evaluation according to the views of the participating students, as well as the results of the data analysis.

Table 2
Gender per school.

Features	Total		Hania		Athens	
	N	%	N	%	N	%
<i>Gender</i>						
Boys	28	60.9	8	57.1	20	62.5
Girls	18	39.1	6	42.9	12	37.5
Total	46	100	14	100	32	100

Table 3

Ex ante-ex post questions 1–3.

Questions		N	Mean	SD	Sig.
1. It would be helpful to be able to communicate with my teacher via a monitor or PC	Ex ante	46	3.57	1.205	
	Ex post	46	3.91	1.930	
2. It would be helpful to be able to attend the lesson via a monitor or PC	Ex ante	46	2.96	1.414	
	Ex post	46	3.48	2.373	
3. Talking to my teacher in person (in the classroom) is exactly the same as watching him/her on the PC screen	Ex ante	46	2.13	1.240	0.015
	Ex post	46	3.15	2.280	

1: totally disagree, 2: disagree, 3: neither agree nor disagree, 4: agree, 5: totally agree.

Table 4

Ex ante-ex post questions 4 and 5.

Questions		N	Mean	SD	Sig.
4. It would be helpful to be able to communicate with my classmates via a monitor or PC	Ex ante	46	3.63	1.466	
	Ex post	46	4.13	2.125	
5. It would be helpful to be able to collaborate with my classmates via a monitor or PC	Ex ante	46	3.67	1.266	
	Ex post	46	3.74	2.175	

1: totally disagree, 2: disagree, 3: neither agree nor disagree, 4: agree, 5: totally agree.

Table 5

Ex ante-ex post questions 6–8.

Questions		N	Mean	SD	Sig.
6. If I were able to attend the lesson via the PC screen, there would be no reason to come to school	Ex ante	46	2.20	1.424	0.041
	Ex post	46	2.89	2.321	
7. I would prefer to attend the lesson via my PC and not come to school	Ex ante	46	2.41	1.484	
	Ex post	46	2.78	2.356	
8. I would prefer to communicate with my classmates via my PC and not come to school	Ex ante	46	2.07	1.289	0.030
	Ex post	46	2.93	2.533	

1: totally disagree, 2: disagree, 3: neither agree nor disagree, 4: agree, 5: totally agree.

Table 6

Ex ante-ex post questions 9 and 10.

Questions		N	Mean	SD	Sig.
9. Playing at school and socializing with my classmates are very important for me	Ex ante	46	4.61	1.064	
	Ex post	46	5.00	1.414	
10. My best friends are from school	Ex ante	46	3.93	1.306	0.012
	Ex post	46	4.59	1.733	

1: Totally disagree, 2: disagree, 3: neither agree nor disagree, 4: agree, 5: totally agree.

6.4.1.1. First query (questions 1–3). Before the VCs, students were positive towards the possibility to communicate (3.57) and more neutral towards attending the lesson via VC (2.96). After the VCs, the positive view appears to strengthen (3.91 and 3.48, respectively) slightly.

Ex ante, the students do not agree that watching the teacher on a screen is the same as being in class (2.13), a view which appears to change considerably after the VCs (3.15).

6.4.1.2. Second query (questions 4–5). The students were rather positive towards communicating with students of a remote class via VC (3.63) and collaborating with them (3.67). Their participation in the VCs strengthened the positive view towards communication (4.13) but did not change it as regards collaboration (3.74).

6.4.1.3. Third query (questions 6–8). The students had a negative view towards the possibility of replacing face-to-face instruction with home schooling via VC. However, their participation in the VCs made them considerably more receptive to the idea.

6.4.1.4. Fourth inquiry (questions 9 and 10). Before the VCs students stated that school and play with their classmates were very important (4.61) and that their best friends were from school (3.93). Their participation in the VCs further consolidated their views (5.00 and 4.59, respectively), with the views towards school friends strengthening considerably.

6.4.2. Second phase: ONGOING evaluation 1–4

Based on the suggested methodology, we briefly present the results of ONGOING evaluation 1, 2, 3, 4, analyzing the views of the students participating in the VCs according to the set queries:

Table 7

First query (ongoing questions 1–4, and 6).

		Mean	SD	Sig.
1. The new instruction method brought me closer to my teacher	OG1	3.76	1.026	
	OG2	3.26	1.255	
	OG3	3.72	1.182	
	OG4	3.62	1.268	
2. I regard the teacher of the other class, whom I watch through the monitor, as my own	OG1	3.40	1.304	
	OG2	3.79	1.301	
	OG3	3.52	1.486	
	OG4	4.00	1.285	
3. The new instruction method was easy to follow	OG1	4.62	0.650	
	OG2	4.48	0.927	
	OG3	4.33	0.993	
	OG4	4.74	0.497	
4. The new instruction method is very pleasant	OG1	4.62	0.576	
	OG2	4.53	0.702	
	OG3	4.60	0.791	
	OG4	4.52	0.784	
6. In which way do I learn more easily?	OG1	3.36	1.222	
	OG2	3.52	1.338	
	OG3	3.35	1.307	
	OG4	3.68	1.386	

1: totally disagree, 2: disagree, 3: neither agree nor disagree, 4: agree, 5: totally agree.

Table 8

Second query (ongoing questions 10–12).

		Mean	SD	Sig.
10. The new instruction method helped me get acquainted with the distant students	OG1	4.33	0.853	
	OG2	4.34	0.939	
	OG3	4.16	1.090	
	OG4	4.64	0.759	
11. I feel the distant students as my own classmates	OG1	3.49	1.502	
	OG2	3.52	1.406	
	OG3	3.60	1.449	
	OG4	4.00	1.379	
12. I want to be friends with some of the distant students	OG1	4.16	1.010	
	OG2	4.16	1.010	
	OG3	4.16	1.111	
	OG4	4.63	0.733	

1: totally disagree, 2: disagree, 3: neither agree nor disagree, 4: agree, 5: totally agree.

Table 9

Third query (ongoing questions 5 and 7).

		Mean	SD	Sig.
5. I like the new instruction method better than face-to-face instruction alone	OG1	3.71	1.272	
	OG2	3.59	1.282	
	OG3	3.49	1.242	
	OG4	3.50	1.109	
7. I would prefer it if I were able to attend classes through a monitor at home rather than come to school every day	OG1	2.27	1.420	
	OG2	2.11	1.401	
	OG3	2.26	1.416	
	OG4	2.80	1.506	

1: totally disagree, 2: disagree, 3: neither agree nor disagree, 4: agree, 5: totally agree.

6.4.2.1. First query (questions 1, 2, 3, 4, 6). Students state that they feel closer to their teacher during the VCs (3.76, 3.26, 3.72, 3.62). Students feel as comfortably with the distant teacher as with their own and this view is strengthened after the VCs (3.40, 3.79, 3.52, 4.00). Students clearly state that the new instruction method was easy to follow throughout the VCs (4.62, 4.48, 4.33, 4.74). Students feel certain that the new instruction method was very pleasant throughout the VCs (4.62, 4.53, 4.60, 4.52). They tend to agree that it is easier to learn what is delivered in the new instruction method throughout the VCs (3.36, 3.52, 3.35 3.68).

6.4.2.2. Second query (questions 10–12). Students feel certain that the new instruction method helped them get acquainted with the distant students (4.33, 4.34, 4.16, 4.64). Also, students tend to agree that they regard the distant students, whom they watch through the monitor,

Table 10

Third query (ongoing question 8).

Question 8		N	%
I would like all lessons to be taught in the current way, only with my teacher in class	OG1	4	8.9
	OG2	2	4.4
	OG3	1	2.2
	OG4	4	8.7
I would prefer it if more lessons were taught in the new instruction method	OG1	7	15.6
	OG2	10	22.2
	OG3	14	31.1
	OG4	10	21.7
I would prefer it if all lessons were taught in the new instruction method	OG1	10	22.2
	OG2	8	17.8
	OG3	5	11.1
	OG4	8	17.4
I would prefer it if lessons were taught in a combination of face-to-face instruction and the new method	OG1	19	42.2
	OG2	20	44.5
	OG3	19	42.2
	OG4	15	32.6
I do not know	OG1	5	11.1
	OG2	5	11.1
	OG3	6	13.4
	OG4	9	19.6

Table 11

Fourth query (ongoing questions 9 and 13).

		Mean	SD	Sig.
9. The new instruction method brought me closer to my classmates	OG1	3.89	1.224	
	OG2	3.56	1.240	
	OG3	3.60	1.294	
	OG4	3.93	1.257	
13. I would like to meet in person the students and teacher of the distant class	OG1	4.64	0.609	
	OG2	4.36	1.080	
	OG3	4.37	1.215	
	OG4	4.60	0.928	

1: Totally disagree, 2: disagree, 3: neither agree nor disagree, 4: agree, 5: totally agree.

Table 12

Discrepancy/variation in connection with the students' computer literacy or their sex.

	Gender				t	df	Sig.			
	Boy		Girl							
	Mean	SD	Mean	SD						
<i>Exante</i>										
Exante 1	3.71	1.213	3.33	1.188	1.048	44	0.300			
Exante 2	3.04	1.551	2.83	1.200	0.470	44	0.641			
Exante 3	2.11	1.370	2.17	1.043	−.157	44	0.876			
Exante 4	3.64	1.592	3.61	1.290	0.071	44	0.944			
Exante 5	3.75	1.351	3.56	1.149	0.504	44	0.617			
Exante 6	2.11	1.257	2.33	1.680	−0.522	44	0.605			
Exante 7	2.32	1.467	2.56	1.542	−0.518	44	0.607			
Exante 8	2.00	1.333	2.17	1.249	−0.424	44	0.674			
Exante 9	4.50	0.882	4.78	1.309	−0.862	44	0.394			
Exante 10	4.07	1.152	3.72	1.526	0.883	44	0.382			
<i>Expost</i>										
Expost 1	3.93	1.804	3.89	2.166	0.067	44	0.947			
Expost 2	3.39	2.166	3.61	2.725	−0.301	44	0.765			
Expost 3	3.32	2.161	2.89	2.494	0.624	44	0.536			
Expost 4	4.21	1.771	4.00	2.635	0.330	44	0.743			
Expost 5	3.71	2.088	3.78	2.365	−0.096	44	0.924			
Expost 6	2.82	2.161	3.00	2.612	−0.252	44	0.802			
Expost 7	2.71	2.275	2.89	2.541	−0.243	44	0.809			
Expost 8	2.86	2.289	3.06	2.940	−0.257	44	0.799			
Expost 9	5.00	1.247	5.00	1.680	0.000	44	1.000			
Expost 10	4.79	1.397	4.28	2.164	0.970	44	0.338			

1: Totally disagree, 2: disagree, 3: neither agree nor disagree, 4: agree, 5: totally agree.

as their own classmates. This view appears strengthened after the VCs (3.49, 3.52, 3.60, 4.00). Students clearly state that they would like to become friends with the distant students, a view which was strengthened during the VCs (4.16, 4.16, 4.16, 4.63).

6.4.2.3. Third query (questions 5, 7, 8). Students appear to agree that the new instruction method is preferable to face-to-face instruction. However, this view is weakened during the VCs (3.71, 3.59, 3.49, 3.50).

Students were negative towards the possibility of replacing face-to-face instruction with home schooling via VC, a view which did not change during the VCs (2.27, 2.11, 2.26, 2.80).

There are a number of students (2.2–8.9%) who state that they would prefer it if all lessons were taught in face-to-face instruction, as it is today. On the other hand, a considerable percentage (15–31%) would prefer more lessons to be taught via VC and a significant number would prefer all lessons to be taught via VC (11–22%).

However, the greatest percentage of students (32.6–44%) states that they would prefer a combination of the two instruction methods.

6.4.2.4. Fourth query (questions 9 and 13). Students appear to agree that the new instruction method brought them closer to their classmates, a view which appears strengthened during the VCs (3.89, 3.56, 3.60, 3.93). Students feel certain that they would like to meet in person the students and teacher of the distant class, a view which remained throughout the VCs (4.64, 4.36, 4.37, 4.60).

6.5. Discussion

The core of the “ODYSSEAS” project was the development and implementation of cross-curricular activities of distant collaborative learning via VC between elementary schools of Greece.

In comparison with survey results of ODYSSEUS in 2000–2007, the instructional approaches first applied in ODYSSEUS 2008 (cross-curricular approach, project method, reinforcement of interaction through animation and face-to-face meeting of students) appear to be effective.

This is illustrated in the following results of the survey:

1. The students of the local and the remote class are positive towards their participation in Video-conferencing. This confirms views recorded in previous surveys of the ODYSSEUS project (Anastasiades, 2003, 2007; Anastasiades, Eleutheriou, & Xambiaouris, 2001; Anastasiades, Christou et al., 2003; Anastasiades, Constantinou et al., 2003), as well as similar surveys in the international literature (Greenberg, 2004; Martin, 2008; Newman, 2005; Newman, 2008). We should emphasize that in an older survey by Wick (1997), the students of the local class were reported to have stated that the VCs were more interesting than the traditional instruction whereas the students of the remote class would prefer a traditional instruction.
2. The interactive activities within this instructional methodology greatly contributed to the satisfaction of students and their further motivation to participate in VCs. This is also confirmed by similar surveys, which pinpoint that the design of interactive activities in conjunction with a well-organized, student-centred instruction is the key factor to an effective VC (Barbanell, 2008; Bidjerano & Wilkinson, 2008; Greenberg, 2004; Newman, 2005, 2008; Newman & Goodwin-Segal, 2004; Omatsey, 1999).
3. As part of the survey we investigated whether the answers differ depending on sex during all the phases of the evaluation: ex ante, ex post and Ongoing 1–4. We compared the averages of the boys' and the girls' answers via *t*-test for independent samples and statistical importance value $p < 0.05$. In the statistic processing of the current data there was not a significant discrepancy/variation in connection with the students' computer literacy or their sex, which was also recorded in all the previous surveys. A possible explanation of this is that the participation in VCs does not require advanced technological skills on behalf of the students, as the suggested instructional methodology lays emphasis on the pedagogical utilization of VCs as a cognitive tool.
4. Participation in the VCs helped students improve their oral skills (speak loudly, pronounce the words articulately), their verbal skills (comprehension and production of speech) and their communication skills (politely request to speak, be good listeners, etc.). These findings are in accordance with those of similar surveys (Comber et al., 2004; Lee, 2007; Ramirez, 1998).
5. The major contribution of the current survey to the ODYSSEUS project is that the suggested pedagogical utilization of VCs led to:
 - (a) The strengthening of social relations among students of the local class at both schools: According to the survey results, the students felt closer to their classmates during the instruction as their participation in the VCs appears to have consolidated class bonds. A possible explanation of this is that students participating in a VC feel that they represent their school or, even more, their homeland and thus, they do their best to achieve their set goals. They seem more willing to discuss and cooperate with the remote “others” (Newman, 2008). This view is confirmed by the findings of the ODYSSEAS VCs and other similar surveys as well (Comber et al., 2004; Lawson & Comber, 2005).
 - (b) The strengthening of social relations of students between the local and the remote class: The students responded positively towards communicating with “other” classmates of a remote class via VC and stated that they would like to meet and make friends with them. This finding contradicts that of an older survey (Storck & Sproull, 1995), in which students are more positive towards their classmates in face-to-face conditions than in distant collaboration. Recent surveys have recorded the students' willingness to broaden their social circle and meet their distant VC partners (Hirsh, Sellen, & Brokopp, 2005). The advances in VC technology (audio, image, etc.) in conjunction with students' familiarization with New Technologies significantly contribute to the strengthening of social relations between students of remote classes.
 - (c) The face-to-face meeting of students from the two schools, which was held in Athens between the 3rd and 4th VC, was an important factor for the establishment of the social element in the school-hybrid class. This fact confirms results of other surveys, according to which the students participating in VCs felt alienated from their distant partners and wanted to meet them in person (Preece & Keller, 1999). The students of the remote classes in ODYSSEAS met in person, exchanged gifts, discussed and played together, which helped to create a very friendly atmosphere but did not contribute to the formation of a learning community (Burke, Beach, & Isman, 1997). This is an aspect we should further investigate in future attempts.
 - (d) The positive response of students to their communication with both teachers (of the local and remote class): This is directly associated with the high level of satisfaction of the participating students. As Marylin and Holznagel argue in their survey (2002), the success of a VC greatly depends on its organization by the teacher and the support of the remote site facilitators.

- (e) Another contribution of this survey is that, while students are satisfied with their participation in VCs, they are opposed to the possibility of replacing face-to-face instruction in the traditional class with VC schooling and a great number of them propose the combination of the two methods. This confirms previous surveys of the ODYSSEAS 2000–2007 project (Anastasiades, 2003, 2007; Anastasiades, Christou et al., 2003; Anastasiades et al. 2001; Anastasiades, Constantinou et al., 2003) as well as recent similar surveys (Wei & Johnes, 2005) and consolidates the view that IVC do not substitute for face-to-face instruction but supplement it.
- (f) School, as a place for socialization, play and fellowship for students, remains the top priority of the students participating in the VCs. This survey brought to light that their participation in the VCs consolidates the role of school as a socialization agent and, at the same time, it broadens their opportunities for communication and expression strengthening their willingness to make new friends.

6.6. Future research

In the light of the above results and the critical overview of similar surveys in the international literature, it is a top priority to re-design the instructional approach, focusing on the reinforcement of social interaction and the development of collaborative construction, reconstruction and dissemination of knowledge on the following axes:

6.6.1. Combination of VC with web environments of synchronous/asynchronous collaboration

The feeling of physical presence and directness of the VC should be combined with the flexibility in space, time and learning pace of the asynchronous environments. Thus, our future attempts should focus on the social networking of students of the remote classes. This can be achieved by utilizing the appropriate Web 2.0 applications (wiki, blog, etc.), thus encouraging individual expression, individual investigation and discovery as well as social interaction (Courtney, 2007, p. 80; Lambopoulos, 2007). Within the context of Videoconferencing 2.0 application, the focal point of our interest lies in the reinforcement of the social element in the "hybrid class" (Anastasiades, 2007), the formation of collaborative learning communities (Garrison & Anderson, 2003), the development of collaborative sharing environments (Kim & Bonk, 2006), the encouragement of students to reflect, organize and take initiatives, co-create and publish learning material to "others" or any audience (Anastasiades, 2009).

6.6.2. Reinforcement of face-to-face collaboration of students

As already mentioned, the face-to-face meeting of students from the two schools between the 3rd and 4th VC had a positive effect on the establishment of the social element in the "school-hybrid class". In future, we should re-design the context of the students' meeting, aiming at the strengthening of team-collaboration through the suggested methodology.

6.6.3. Improvement of the evaluation methodology

We should reconsider the way and time allocated to fill in the questionnaires in the 2nd phase (Ongoing 1–4), so that we optimize the validity of students' answers and emphasize on their views given in essay form. A key point in future research is the further investigation of the social relations between students and teachers participating in VCs in the context of the emotional and social atmosphere in class.

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