Abstract: This paper intends to present the educational aims, objectives and results of our pedagogic methods to teach design with the aid of technology. The vehicle to fulfil this intention ran in a module form in the Schools of Architecture of Thessaloniki, Greece and of Plymouth, UK. The primary aim of the module introduced by the experiment was to generate the grounds and to give rise to opportunities so that the students could have the possibility to study through well-known contemporary architectural examples the relationship between thinking of and about architecture and doing architecture. The principal means to present this study was the computer. Some of the emerging questions from this experiment were what educational practices should we develop in order to support such an approach in the studio? What role should new technologies play in such an attempt? The experiment attempted to respond to these questions. In the module we attempted to implement our methodological viewpoint on the teaching of design based on the pedagogic starting point of the method of critical commentary. A brief review on the history of design teaching is described in order that our argument and chosen teaching methods to become clear. The theoretical and ideological content of our design teaching methods is described in relation to the module and in relation to the outcome.

1. Design Education, Studio and Computers

"All that is solid melts into air" Karl Marx

Beyond their use as tools to represent and project space, have computers the capacity to be utilised to develop the creativity and critical ability of the student during the design process? Are computers in the position to perform as educational tools that can contribute to the clarification of the values that govern the contemporary architectural practice and the new priorities that have emerged from the current debate about architecture and the city? These are the two main issues that this presentation wishes to tackle contributing this way to the current discussion on architectural education, raised in a broader (cultural) context that is characterised more from the questions it poses than the answers it provides.

In the last decade we experience a particular condition in architectural education. This condition is characterised by a feeling of frustration, which emerges from a dynamic, where the old takes time to die and the new takes time to be born [Gram71]. Such a condition is more or less a structural characteristic of the architectural creation throughout history. Architecture is always nourished by radical cultural and social changes and transformations happening in history and labelled, very often as 'crises'. Similarly, the teaching of architecture is animated by the obsessions and the impulsiveness stimulated by such crises.
It is characteristic that nowadays the particularities of such condition are transcribed in the domain of architectural education through the radical review of all solid certainties which sustained the architectural education and practice up to the 70s. As expected, these reviews and reassessments were translated into the search for new programmes, educational priorities and policies as well as educational methods and pedagogic strategies. In the framework of these speculations, the teaching of design has always been placed in the central position, and the role of the studio into the framework of architectural education, seeks the redefinition of a contemporary content. The emerging question is what should be the teaching of design for the architecture of today (rather of tomorrow)?

In the history of the established architectural education and more specifically the teaching of architectural design, we could distinguish two main axes on which the objectives of the educational process evolve. The first concerns the cultivation of the creativity and imagination of the student and the second, the cultivation of his or her critical thinking on contemporary and past examples. We could argue that the history of architectural education is the history of transformations that the contents of the term 'creativity' and the term 'critique' have undergone.

The studio has been the place for synthesis, interweaving and co-existence of these two axes. It is interesting to note that in the teaching of design the axis of critique takes, with time, greater gravitas. The history of the teaching of design is shaped through a series of versions of a common pedagogic starting point: of that of the 'method of critical commentary'. The main characteristic of this method is that the student's knowledge and ability to design is acquired through the formulation of rules and design directions resulting from two main teaching processes: the one is the process of spotting mistakes by the teacher. The second is the process of developing arguments about the validity of the recognition of those mistakes. In this case, the task of the teacher is to notice those elements of student's design proposal, which are incompatible with the dominant, for the time, value system. At the same time, the student's task is to develop, with his or her own esoteric mechanisms, those creative actions, which could ensure the effective expression and representation of these values in architectural ordering and form. Nowadays, it is a fact that more or less personalised appreciation of the correct, the useful and the beautiful in architecture have replaced the broadly accepted values of the collective movements and manifestos of the first half of the century. As a consequence the concepts of creativity and critique, are in a continuous process of redefinition, a fact that has a direct impact on the teaching methods as well as on the teaching tools [Spir96]

The appearance of new tools to represent space and the advanced possibilities of the computers to assure multidimensional presentations of the designed space, constitute nowadays important parameters in the discussions of current design teaching methods [Wron97]. Computers are already established in architectural education. Sophisticated computer applications constitute in our days the necessary infrastructure of schools of architecture, introducing students to new and more or less unknown ways to represent and to think about urban and architectural space [Qaq97]. The rapid implementation of computers in the design studio found schools unready to develop new teaching practices and pedagogical methods adapted to the particularities of this technological infrastructure. Most schools of architecture continue to follow traditional teaching methods to teach design in a studio equipped with computers. Using this infrastructure just as an efficient drawing tool to visualise students’ design proposals, teaching is very often dictated just from the charm of technology.

As a consequence, the possibility to embody the role of computers into the process of developing the creativity and the critical thinking of the designer constitute a fundamental question/request in the current debates on design teaching. In what ways and for what purpose must computers be used to educate architects? Which pedagogical framework must be developed to introduce creatively computers to architectural education? This framework of questions was the starting point for an educational experiment developed between a small number of European schools of architecture (Schools of Architecture of Plymouth, Portsmouth, Vienna, Strathclyde and Thessaloniki collaborated into the framework of the Archimedia project supported by the Socrates ODL program during the years 1996-1998).

This experiment aimed at the investigation and implementation of innovative teaching methods and pedagogical approaches to teach architectural theory and architectural design using computers and network facilities.

This paper will tackle the aforementioned issues through a critical presentation of our educational experiment as that developed in collaboration with the schools of architecture of Thessaloniki and Plymouth. Similar but very few examples have made an attempt to teach architectural concepts through the study of precedents [Park97]. Since the
Archimedia experiment constitutes the experimental implementation of a methodological viewpoint on the teaching of design. We consider it necessary to describe briefly the fundamental assumptions before we describe the actual experiment. We will, therefore, attempt to relate these assumptions to the different approaches to design teaching currently implemented in schools of architecture.

2. Teaching (hypo)theses

"The point of critique is not justification but a different way of feeling: another sensibility" Gilles Deleuze

The method of critical commentary discussed earlier appears to have a diachronic consistency. It is, however, interesting to note that there are many versions of it which emerge primarily from the different educational objectives and pedagogic strategies [Don96]. Although the typology of these different versions has an historic dimension, it would be true to say that the representative expressions of these versions co-exist nowadays (in pure or hybrid form) in almost all schools of architecture. At least three versions of critical commentary in current design teaching could be noted.

In the first one the educator attempts to put forward through his or her comments, fragments of a body of knowledge, the composition of which is left, by and large, to the student. In this particular case, the critique has as a reference point a, more or less, defined value system with which the educator attempts to familiarise his or her student. The student, in turn, is asked to play a rather passive role, since he or she has to copy or reproduce a rather predetermined relationship between the meaningful content and its expression by means of architectural form. This relationship is offered to the student as valid, and is legitimised, by and large, on the basis of a scientific argument or a transcendent version of the beautiful and the correct. Such an educational approach resembles the educational practices during the era of the Modern Movement. It reflects, to a great extent, a conception of architecture based on the assumption that there is one and only objective truth.

In the second one the critical observations of the educator aim at defining a series of key-issues which emerge from the work of the student. These key-issues constitute, as a matter of fact, some accepted meaningful contents of the architectural propositions such as the urbanity, the identity, the typology, the tradition, the continuity, the memory and so on. This way, the student delves into the intentions and the aims of design, that is the content of the design proposition. What the student ought to learn in this case is to undertake the dynamic role to express this content, through his or her formal codes and the maximum possible legibility. Such an educational approach resembles the educational practices, which emerged in the 70s when the Modern Movement was in a crisis and discussions on 'the Post of the Modern' emerged. In this case, the content of the architectural form although given as is the case in the previous version, is not constant. It depends on social and cultural parameters and their history. As a consequence this content needs to be investigated and located. The critical observations on design teaching made by the educator are aiming mainly to control, the student's individualistic architectural formal discourse which represents an objective socio-cultural content, resulted by the analysis.

In the third one we feel at home. According to this version, the aim of design education should not be about the familiarisation of students with predetermined certainties and arbitrary dogmas that are offered as objective. Design teaching should not either be about the obsession on the level of expression of a false content, which would be defined by an empirical analysis as a social meaning, and as such the objective basis of design. On the contrary, design teaching should aim at teaching students the ways in which they can learn architecture. That is to say, the ways in which they can acquire the knowledge from the simultaneous critical preoccupation with two fundamental issues of the design process. The first concerns the question of what is the nature of the content of design and how that is articulated. The second concerns the question of how the architectural form can reflect a particular sensitivity to that content.

We believe that a great part of design is not only the translation into architectural codes of a question posed by others. The articulation of a question, which will constitute the guide for action for both the student and the architect, will also constitute the fundamental action itself during the design process. This action has to be enlighten by the educator in
order to give the student the possibility to articulate the question in relation to the design theme, so that this articulation to become the means for scrutiny of the student’s worldview, the student’s feelings, sentiments and obsessions. Only in such a practice architecture is transformed into expression, representation, happening or, another sensibility.

The investigation of this particular relationship between the ways of feeling the world and the ways of doing architecture, penetrates even today with great difficulty in architectural education in general and more specifically into the studio. We believe that such investigation should be a structural element of design teaching as long as it allows the comprehension of the ways in which values, concepts, and sensations stimulate, motivate and drive architectural creation.

What educational practices should we develop in order to support such an approach in the studio? What role should new technologies play in such an attempt? The Archimedia experiment attempted to respond to these questions. The primary aim of the module introduced by the experiment was to generate the grounds and to give rise to opportunities so that the students could have the possibility to study through well-known contemporary architectural examples the relationship between thinking of and about architecture and doing architecture. The principal means to present this study was the computer.

3. Computer Aided Critical Architectural Analysis

"L'imagination imite, c'est l'esprit critique qui crée" Jules Supervielle

the principles

Every architectural proposition constitutes a representation, or the expression of a certain way of understanding architecture and effectively a broader attestation of the context in which the design practice takes place at a certain point in time. The study of architectural examples which belong to a certain era, not only clarifies the morphological and functional characteristics of the example, its technological innovation and all other features that comprise its identity and differentiate it from all other examples, but it has also to expand to:

- The domain of broader theories and viewpoints (philosophies and ideologies) which comprised the intellectual context in which the example emerged.

- The ideas and values of the architect which constituted the base on which the accomplishment of the example laid.

- The principles that governed the ways in which the architect thought in order to come up with the example in question, but also of the way in which these principles informed design manipulations during the design process.

- The mapping of the example in the overall work of the respective architect.

- The criticism that the given example has evoked when it was integrated in its immediate as well as its broader context.

The viewpoints, ideas, principles, values, but also the myths, metaphors, notions, meanings and words comprise a structural part of architecture which is inseparable from the materiality of its form, the organisational value of its function or its technological advances.
The possibilities that computers offer enable the presentation of a study of an architectural example, which can cover a whole range of issues like the ones mentioned above. Until recently the use of computers has been directed into applications which ensure the possibility of representation of buildings and projects in the architectural and urban domain. As prime representation tools, computers have integrated in architectural education aiming mainly at familiarising students with the use of CAD programmes and the established representational techniques of design ideas.

The proposed experiment shifted the focus from the skill to use computers into critical investigation and understanding of examples in architecture, with the support of computers. This way, an attempt was made to utilise technological possibilities at their best in CAD labs and studio teaching in subjects related to theories of architecture. By using multimedia and a presentation of a systematic and thorough analysis, which contributed significantly to the best comprehension and investigation of the features of an example, was possible.

Despite the fact that the investigation of current trends of architecture appears as an obvious theme for a course in architectural education, there are not a lot of schools of architecture in Europe that pride an autonomous course that focuses on this subject. Debates about the current architectural and urban design appear tentatively in the studio (adapted to the particular orientation of the studio) and in some courses on theory of architecture and design (presented according to the teachers' theoretical viewpoint). Courses with titles such as 'Contemporary Architecture' belong usually to the domain of the history of architecture and are oriented towards the architecture of the Modern Movement or the architecture before the 70s.

The objectives

The main educational objectives of the module were the following:

- The definition of the analysis of architectural design as a structural element for the deep understanding and critical comprehension of ideologies that comprise the body of theories in architecture.

- The examination of current architectural examples in the agenda of a module which aims at the comprehension of current trends and approaches.

- The occupation of students not only with the form or function of the buildings they study, but also with a whole range of ideas, principles and values which structure designers' thinking and drive design ideas.

- The familiarisation of students with the current technological possibilities of computers, multimedia and CAD programmes, during an educational process, which simultaneously ensures a more profound understanding of the architectural experience.

- The collaboration of students for the profound comprehension of issues concerning architecture and the dissemination of their experience between them and students from different countries.

the module

The project partners defined and agreed at the very beginning of the project a number of the most typical European paradigms of architectural and design projects of the last twenty years that students should be aware of. The idea was that every student would analyse a building according to the following issues:

- Information about the brief of the project.

- Information about the architect of the project.
• The architect's priorities, orientations, values, ideas, metaphors, concepts and principles which have determined the main design decisions and organised the design process.

• The organisation of the plans of the building.

• The structural and construction aspects of the designs.

• The study of plans, sections, elevations and 3D models of the project assisting to the better understanding of the project.

• Comparison of the project with other projects of the same architect, or other similar projects designed by other architects.

• Bibliographical references and written reviews on the projects.

The course took place the same day and time in all schools, on-line through the NET. Students working on the same subject for five weeks (twice weekly on a three-hour basis) could contact and collaborate with students from the other schools working on the same project, the same category of projects, the same competition projects or the same architect's projects. They were paired and had discussions on the respective examples they were studying through the Internet using e-mail and Microsoft Netmeeting. They could collaborate on particular subjects of the architectural analysis, and exchange approaches, aspects and critics on the elaborated projects and ideas for the presentation of the analysed paradigms. Discussions on the existing literature and publicity related to the contemporary examples chosen took place in the first week. The students undertook the literature review and found all related information. Study of the findings was fed back to in-class discussions. Visual and auditory communication was achieved with microphones and cameras. The images and text exchanged were scanned and used in digital form. Collective class meetings between the two ends took place twice in the duration of the course. Teachers on architectural theory supported the teaching. The schools' computer technicians offered technical support. The teaching staff delivered lectures on how buildings are analysed in order students to be supported during the module.

The student output was web-sites, which included text and images of the examples studied. The expectation was to generate an Electronic Architectural Archive. The archive was intended to comprise an interactive system in which, according to the user's choice, tracing of its contents would be possible. Moreover, the comparative presentation of design principles, viewpoints on architecture of a certain architect and other critical observations, which the contributors of the network would incorporate to the system, would be possible. This archive could constitute excellent educational material in the design studio for the support of the educational process. This material could support effectively the critical comment of the educator on examples and students' proposals with referencing, comparisons and juxtapositions.

4. Re(-)viewing the experiment

"It is your trained mind, you remember, which prevents you from learning" Timothy Leary

The experience gained from the experiment allowed us to make a series of critical observations, which we thought appropriate to discuss. These observations do not derive from a systematic process of assessing the module taking into account a predetermined group of criteria. On the contrary, they comprise more empirical observations of the students' behaviour during an educational activity which aimed at the creative co-existence of the unrestrained charm of the advanced (re)presentation means, and the rules and principles governing the subject of the (re)presentation. We will, therefore, present some of the most important characteristics of student behaviour of both schools from which we can draw the emerging issues relating to the effectiveness and the role of computers in design teaching. These observations have a critical nature and have been classified into two sections. These that concern student performance, and these that
concern the educational process.

the students' performance

1. A first observation concerns the role of discourse in the presentation of the work. During the verbal communication and discussion in the class the students were in a position to develop particularly complex architectural ideas and analyses. Their response to theoretical debates was very satisfactory and their concern about the content of architectural propositions genuine. Nevertheless, the text that accompanied the presentation was purely descriptive of the building or the architect studied, but interestingly enough, most of the time, was unrelated to the images it was meant to support or was next to. The discourse employed in most of the cases had journalistic style and did not intend to delve into real architectural issues. As a result the importance of the text was devalued while brief comments played the role of an unsophisticated caption. The students encountered difficulties in portraying effectively their thoughts through the presentations that they undertook.

• Undermining the importance of the discourse the presentation of the examples pushed forward the dominance of the images. Since, however, images came from architectural journals and from the Internet, the presentations lacked a great degree of the expected critical and analytical dimension that the module intended to give. The presentations on many occasions were limited to a display of images and information, which were not in a position to develop a coherent analytical view or a critical approach to architecture.

• In the presentations a dominant role was played by the graphics as that was offered from the computers. In fact graphics competed and dominated the actual architectural analysis in written form. It was interesting to observe that while the work progressed into the presentation the students' interest shifted from the content of the text for the analysis of the building studied into the images and after into graphics, which finally became an end-in-itself exercise. In most of the cases, images and graphics were offered uncritically and left with no comment, as there were no indications as to how one could make good use of the observation of the images available.

• The overall output of students' work was presented with no clear intention and hierarchy of components. The websites consisted of pages constructed at random both in terms of the text and the images included. A coherent strategy behind the sequence of the components and the succession of the pages presented was generally absent. In effect the studies appeared fragmented and the story line discontinued or non-existent. They followed some more or less neutral subjects like the architects' biography or other selected works, and bibliography touched the presentation of the selected building to be done in terms of plans sections and facades.

• The bibliographical references appeared to play a rather significant role in the study since they possessed a great part of the presentation. However, in the actual text there were only a few associations made between the students' comments and the content of the references. A great part of the references emerged from the Internet and unsuccessfully replaced or substituted the investigation and research of valuable books or journals.

• The analysis, when it eventually and marginally occurred, was based on the architectural journalists' comments found in references or students' ungrounded speculations. There was no consideration of the discourse of the architect responsible for the actual edifice. The attempt to understand a building within the framework its architect operated in had neither critical nor analytical character. The presentation of architectural works and their analysis quite often ended up being a passive presentation of plans and photographs. The technology of the buildings studied remained on a descriptive level, and unrelated to the architectural content and intention that led to the choice of the adopted technology.

consequences/impact on the teaching process

1. When the project was set up it was taken for granted that the analysis of buildings was a known task. This
hypothesis which was also a presupposition for the experiment to be possible proved to be wrong. Disappointedly, it was realised that the students did not possess the tools and the experience to delve into the analytical procedure of understanding and appreciating architecture. This weakness to meet the objectives of the experiment concerning the analysis of buildings was a hindrance that shifted it into the exploitation of the computers and the graphics they can offer. The difficulty the students had to form and articulate an argument encouraged this shift and legitimised computers and graphics as the students' main concern.

- The experiment took place between five different European Schools. Due to particularities of the school curricula and the effective incompatibility, it was not possible to run the project at the same stage in all schools. More specifically, second and fourth year students undertook the study in Plymouth and Thessaloniki. Interestingly enough, while in a similar study the degree of sophistication and profundity of analysis is evidently and directly related and analogous to the stage the student is at. In our study this was not the case. In fact students were similarly fascinated by the technological aspects of the exercise and neglected the academic rigor that was necessary.

- This shift also changed the conventional relationship between students and staff on a theoretical project, like our experiment, where normally conversations with intellectual rigor and sophistication take place on how to think, analyse, argue and debate about architecture. The contact between them was limited to technical questions the students posed and the technical support staff could offer.

- The nature of operation, working on computers in the school or at home, entails a genuine isolation, which in the particular case of our experiment hindered and discouraged discussions and debates between students on the actual theoretical content of the exercise. Exchange between students was limited to technical issues such as techniques, use of software, addresses on the web etc.

- A large number of students worked at home. As a consequence there was no concurrent development of the project. Therefore, they encountered different problems at different times. Discussions on similar matters were impossible and only corridor chats on technical problems and techniques took place.

- The digital form of presentation on web pages, unlike conventional presentations pinned on the wall, made communication between staff and students difficult. It was not possible for either party to have an overall view of the outcome, but of fragmented images and text. The lack of a continuous story line made the work incomprehensible.

5. The charm and the rigor

"C'est quand on a oublié ses doits que l'on fait de la musique" Luis Kahn

In many schools of architecture computers have been placed physically with no clear idea of their role in the curriculum as a mere tool of presentation and/or as a 'designer'. Computers when available, therefore, are seen as a new fascinating toy which understandably, given the difficulty to scrutinise architecture, becomes the centre of attention. The module we described was designed to support design teaching. This support lies on two levels. The first one concerns the investigation of the design process through the critical analysis of distinguished examples. More particularly it concerns the investigation of the relationship between a conception of the world and of the architecture as part of that world, and a transcription of this comprehension into architectural terms. The second level concerns the familiarisation of students with a new means for expression. In order for this means to become effective, students must dispose the necessary technical know-how. The difficulties we have come across in the implementation of the experiment and the problems we located derive from the fact that students from both schools were not in a position to move effectively on both levels.
It is intriguing that in neither of the two schools, and that was the case in the other schools too, the analysis of contemporary architecture with regard to the framework of values and principles, is not developed in a systematic way. The module gave students the opportunity to feel that dimension even though they did not have the time or the willingness to delve into it. The fact that such an analysis competed (even with no big success) with its organised presentation constitutes for us a particular benefit for the students. We believe that the articulation in one module between architectural analysis on the one hand and its presentation supported by multimedia on the other, could make a very significant contribution to the design teaching. The experience of such a module could be then be integrated with the design process, and the contents (values and principles) of the analysed building could be replaced by the conceptions of the student (of values and principles). At the same time, the formal choices and the manipulations of the analysed architects will be replaced by the personal manipulations of the student/designer.

The observations described earlier allude us to the following conclusions-suggestions for the position of such a module and the way to be implemented:

1. The teaching of students in computers should stop being limited to their familiarisation with the application of certain software packages. On the contrary, it should be incorporated in educational activities of a broader range which would allow the use of computers to support educational aims more directly related to architecture.

- Students' familiarity with multimedia and new technologies should begin from the first stages of education with no intention, on the other hand, to replace traditional drafting techniques. What the students should practise is the development of creative possibilities of their personal expression and not only the assimilation of a technical representation of space.

- Modules investigating the analysis-presentation relationship must be introduced to the curriculum from the first stages. These modules must have a continuity during architectural studies in order to ensure a deeper and broader understanding of the theoretical and technical issues emerging from the above relationship.

- These modules must support design studio modules. Their support will be concerned with the analysis and the presentation of examples related to the design theme of the studio. These examples will create a framework of references for staff and students of the studio.

- The possibility students have to communicate with their peers outside the class, plays a catalytic role. This, in the case of our experiment, motivated the students to hear other approaches, understand other views and arguments and develop a spirit of noble emulation between them.

The analysis presupposes a rigorous and critical definition of values and principles, and their consistent respect. The presentation presupposes imagination and elegance. We believe that the creative articulation of rigour and elegance comprise the vital components of architectural design, and this is the reason they deserve our attention as teachers of architecture. From our experiment it has become apparent and has taken us by surprise to realise that the seduction generated by computer graphics is not the only problem. On the contrary, it is an experience which allowed us to realise that it is also difficult for us to teach the deeper mechanisms of architectural creation, irrespective of the use of computers or not. Both of them, means for expression and the ability to criticise must be under the full control of the architect. We can play the music only when we forget our fingers…

References

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In this case Antonio Gramsci's realisation would be valid: that is that such a condition gives birth to monsters (Prison Notebooks, edited and translated by Quintin Hoare and Geoffrey Nowell Smith, International Publishers, 1971). As monsters, in architecture, we could define the desperate attempts made for the values of the old to be expressed through the formal expressions of the new.


