Investigate the effects of scientific software Learning and programming in physics and engineering control

MOHAMMEDI Ferhat[1] **, BENSAADA Said**[2]

[1,2]LARHYSS Laboratory Research Group of Laser Engineering Physics B.P145.R.P 07000, University of Biskra Algeria

ABSTRACT

The term learning computer sciences (LCS) refers to an interdisciplinary field that works to further scientific understanding of learning as well as to engage in the design and implementation of learning innovations, and improvement of instructional methodologies. The primary goal of this paper is to enable the reader to generate readable, compact, and verifiably correct Computers programs that obtain numerical solutions to a wide range of physical and empirical models and display the results with fully annotated graphics. While computer programs can be used in many ways, the emphasis here is on building computational models, primarily of physical phenomena (though the techniques can be easily extended to other learning systems). Implications for mathematics curriculum development are explored.

KEYWORDS

Write scripts, files, Matrix Laboratory, computation and visualization, computers.

INTRODUCTION

Teaching for Scientific Computing specialty channels (LCS) in first and second degree of scientific class series aims to provide an introduction to concepts, methods and problems of computer science for, integrating the implications of information the environment and the daily life of students.

Teaching or learning in computer and programming in advanced mathematics cannot be conceived nowadays without numerical experimentation on computers. There is a vast literature devoted either to theoretical models or numerical programming of basic algorithms, but there are few texts offering a complete discussion of phenomenal issues involved in the solution of concrete and relatively complex problems. This contribution is an attempt to fill this need. Same problems which are more theoretical, all projects follow the typical steps of scientific computing: physical and mathematical modeling of the problem, numerical discretization, construction of a numerical algorithm, and, finally, programming. As with any branch of science, computer scientists perform research that establishes new information. This research begins with known mathematical algorithms and computer theory, and strives to constantly redefine what technology can do for us. Computer science also addresses how existing technology can be used in ways previously undiscovered; creating applications that may be faster, simpler, more efficient or less costly. In Scientific Computing courses, we want our students to gain a comprehensive and conceptual understanding of engineering principles and not have to struggle with the mathematical and numerical aspects of engineering problems.

The following are the main reasons:
Defining User Requirements
Functional requirements-
Data requirements- Physical environment-
Social environment-
Required technologies -Required user skill- Usability requirement
Use of computers:
The computer is now an everyday tool in schools.
Everything is computerized. Computer file management allows students absences, examinations. Schedules are prepared by dedicated software; students' scores are entered into the database of the institution, which allows out the transcripts of students, draw statistical curves for each student to identify difficulties. In the classroom, some teachers use video projection Digital courses they have previously prepared on computer: all media are license (image, sound, video) Now , many schools have a computer room, connected to the Internet. Educational Centers now make available resources computer. On the Internet, Educnet portal references for resources IT for education. Nowadays, it is even ready laptops to students! IT is a reality in education. But let us examine the specificity of its use in Physical Sciences .

The computer in teaching
1 . Role of the teacher
During my internship, the question of the personal investment of the teacher in computerization of discipline came to mind. It appears that integrating the computer physical sciences is difficult workload and all the problems caused are significant. In addition, the choice of the computer is not general, all teachers the not commonly use in their teaching.
a. The computer, a choice A reading of official documents, an initial response is given as to the disparity the choice of computer. Although the educational objectives are the same for all Students, the choice of teaching methods and approaches under the initiative and the responsibility of the teacher. This general instruction in education for because the diversity of teaching situations. Diversity of teachers and students, diversity of situations and knowledge to be transmitted, this variety of cases involves give teachers their freedom of action. Thus, it cannot force a teacher to use the computer as it is not part of the program. If he chooses, he will be his responsibility to him to make the best for the quality of its teaching
students . Although the programs propose to use IT, Education bet more about the teacher. IT support is not considered as a good tool or bad because its educational value depends on its implementation and its exploitation teacher. They must be reasoned, otherwise the student will derive no benefit compared to a conventional learning. This does not mean that we restrict the use specific situations, but there must be a preliminary work of preparation and explanation to the student. We will return in the next section.

b . Learning these new technologies

Freedom of choice being offered to him, the teacher must be courageous and patience. Although the solutions purchased by laboratories are now delivered " key hand , " teachers must acquire these systems. User manual, test prior by increasing difficulty ... In a matter or experience is king, these are opportunities for teachers to apply what they teach ! Teachers who are committed to take this route completely , and know that the hours spent learn to use the software and hardware are paying. It is clear that this support is much easier to integrate than one control personal computing. The common use of the computer for typing documents, surfing the Internet are already very useful. But hardware knowledge can also be very useful! To complement these skills, teachers can also choose courses in the field of computer-aided experimentation, to learn how to use the computer in other areas of science physical.

Use of computersAn important place for projects: To give a concrete answer to the expected heterogeneity of the group class, it is proposed to establish a teamwork based on a project teaching and promoting the emergence of a group dynamic.
-The development of effective time management with respect to a schedule;
-The formalization of the constraints related to the allocation of tasks in a team;
-The value of the result of a collective work. Teamwork on projects developed sociability, communication and
methodological skills such as the ability to define clearly objectives, and to provide the means to achieve them all these objectives are relevant to higher education.
Project work is tackled in different projects

Pedagogy:

In the framework of a project, the teacher always puts students in the position of research, even if it can guide and support student research .

To guide project teams towards achievement of their own and succeed in time, it may be necessary to clarify several points with the students:

- The role of the pilot project is to say one who coordinates the work within a team.
- The notion of "model" (limited version of the project, suggesting feasibility , a direction to follow, and to refine the specifications and / or timing , and prevent leaks in the front)
- Documentary approach, which will have to perform a search for sources of information believed to be reliable and suitable for the theme of the project (see below) and the teacher may ask :
- Compliance with the specifications intended to clarify what is expected , the features to be developed, minimum requirements in terms of quality and particularly the human-machine interface (HMI), etc.
- The appointment of balance in order to clarify the project's progress , redefine some aspects if necessary , report dimensions have been neglected or misperceived , etc. .

And schedule specifying the times at which most of the development is to be completed and made an initial presentation

The literature search:

The literature search is an essential dimension of any project (whether for rer recovered technical specifications, inspect conventional solutions, avoid reinventing what is already known for a long time, etc….).

Collaborative work:

Collaborative work induces the need to structure the entire production team, requiring the provision of collaborative digital spaces also allow the teacher to monitor the progress of the project and to formulate effective recommendations in a timely manner.

The choice of themes

Projects and mini- projects by students are a fundamental learning. Themes can be very varied and differentiated according to the groups. By cons, they must be modest and achievable goals within a limited time, so as not to encroach on other disciplines.

The topics are important and earn respond, to the extent possible, to problems from other

disciplines, but they were initially intended to devise solutions to the expression of adesired.
- Projects, non-exclusive manner during the conduct of projects:
it is possible to conduct; parallel work on other concepts while ensuring allow sufficient time for students to manage their projects . In addition, working in groups or teams can also be adopted in the context of subjects over time nature by using a distribution of several study groups operating in parallel.
Practical organization of teaching: Teamwork is centered on projects adapted complexity and growing and progressive difficulty in the year, particularly in the organization of mini-project of the second period. The proposed different solutions and their critical comparison could be the basis of teaching.
Equipment hardware: It is therefore necessary to reflect on the subject, with the aim of providing students and teachers to, in the context of education (LCS-learning for computer science), a comfortable operating system, secure and enabling number system such as software installations share. Several tracks (non-exclusive) can be followed for this reflection

1.Envisager recycling machines a little used to dedicate to LCS (practical work and projects should not normally seek new computers or high power) . may even consider open and disassemble and reassemble one or two machines in the presence of students, then connect a network independent educational network , with a suitable operating system (Linux is well suited to this kind of use).
2. If accommodate the system and the existing network, creating special accounts for students enrolled in CHA accounts with a few more rights than others. This approach poses problems security .
3. Work with bootable USB key (provided to allow booting on external devices). The system is then that which is contained in key (previously determined by the teacher), and access to the Internet directly (by the bridge) , no network.

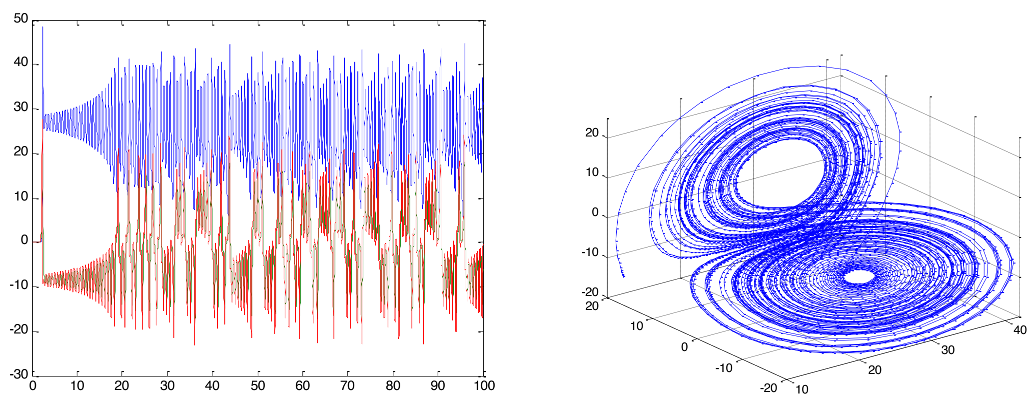
Software equipment
To work comfortably and effectively, it is useful to provide students a number of versatile and specialized software but whose features contribute to the realization of complex projects. Almost all appropriate software are free and all are free software, essential to ensure that students have the opportunity to access legally, without limitation, the same software home and in the establishment. In many universities, under legislative system LMD (Licence Master Doctorat) , to accommodate these reductions, some have dropped the Numerical Methods course or reduced its credit hours. Other programs have bundled numerical methods in courses such as ‘‘Quantitative Methods’’ where students are also expected to learn linear algebra, programming language, or computational system, and complex analysis; Most universities currently use one of the following four computational systems in their engineering curriculum—Mathcad, Maple, Mathematica, or Matlab. Also, to teach and illustrate numerical methods, many departments of engineering use textbooks and examples geared toward their specific area or major.
A physical system is modeled first conceptually, using ideas such as momentum, force, energy, reactions, fields, etc. These concepts are expressed mathematically and applied to a particular class of problem. Such a class might be, for example, projectile motion, fluid flow, quantum evolution, electromagnetic fields, circuit equations, or Newton’s laws. Typically, the model involves a set of parameters that describe the physical system and a set of mathematical relations (systems of equations, integrals, differential equations, eigensystems, etc.). The mathematical solution process must be realized through a computational algorithm—a step-by-step procedure for calculating the desired quantities from the input parameters.
This study covers geometrical optics, electromagnetic theory, interference, and diffraction and coherence theory. Chapters on optical constants, blackbody radiation, emission and absorption, lasers, holography and Fourier transform spectroscopy broaden its scope. The

mathematical solution process must be realized through a computational algorithm—a step-by-step procedure for calculating the desired quantities from the input parameters. The user has a choice among the four most widely used computational systems, namely, Maple, Mathcad, Mathematica, and Matlab. There are two main reasons for developing simulations using all the four computational systems

Visualization Environments combine traditional Visualization techniques

For most practical applications, researchers try to find the best visual representation of the given information. That is the core problem of each visualization; but sometimes the seemingly best representation does not suffice if the human information processing and the human capability of information reception are not adequately taken into account. Additionally, these aspects depend on the data to be visualized and on the user's background. While developing Human-Centered Visualization Environments, user abilities and requirements, visualization tasks, tool functions, and visual representations should be equally taken into account. The design of Human-Centered Visualization Environments is one of the big challenges of Information Visualization, Software Visualization, and of many application areas, such as the visualization of biological/biochemical or geographical information.

In our study this topics With Applications from Mechanical, Aerospace, Electrical, Civil, and Biological Systems Engineering. While computer programs can be used in many ways, the emphasis here is on building computational models, primarily of physical phenomena (though the techniques can be easily extended to other systems). A physical system is modeled first conceptually, using ideas such as momentum, force, energy, reactions, fields, etc. These concepts are expressed mathematically and applied to a particular class of problem. Such a class might be, for example, projectile motion, fluid flow, quantum evolution, electromagnetic fields, circuit equations, or Newton's laws. Typically, the model involves a set of parameters that describe the physical system and a set of mathematical relations (systems of equations, integrals, differential equations, Eigen systems, etc.). The mathematical solution process must be realized through a computational algorithm—a step-by-step procedure for calculating the desired quantities from the input parameters. The behavior of the model is then usually visualized graphically, e.g., one or more plots, bar graphs, or animations;



(a) time responses of the state variables b) 3D phase space trajectory

Simulation results of the Lorenz equations

Examples severally topics: Students introduced to numerical methods with generic functions and data without direct relation to physical applications easily lose interest in the course. For each mathematical procedure, models (next Figure) of six physical models examples (corresponding to engineering major) are developed to show the need for finding solutions numerically. The examples chosen then become a common theme for developing and comparing different numerical methods practical work of students in topics The Heat Equation, The Wave Equation, Laplace's Equation, The Fourier Transform and The Laplace Transform

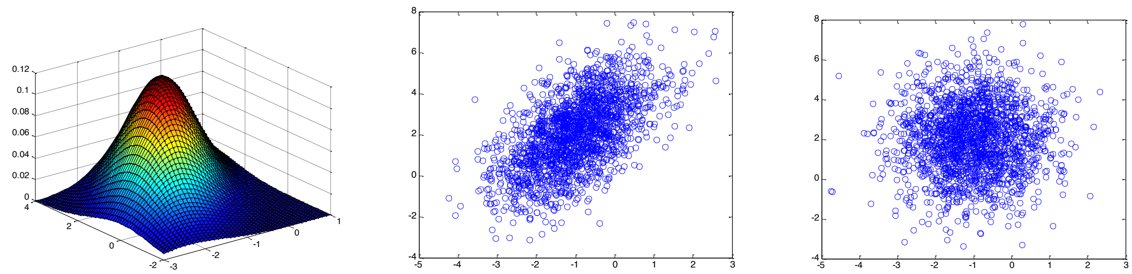


Figure 1-Monte Carlo solutions to mathematical problems

Advantages for teaching Physics:

-a. Reflect the reality of science

-b. Overcome barriers of mathematics

- C. Focus the discussion on the physical

The experimental approach by the computer:

- Observation
- Formulation of Hypothesis
- Experimentation
- Measurement and Modeling
- Interpretation of Results
- Communication of Results

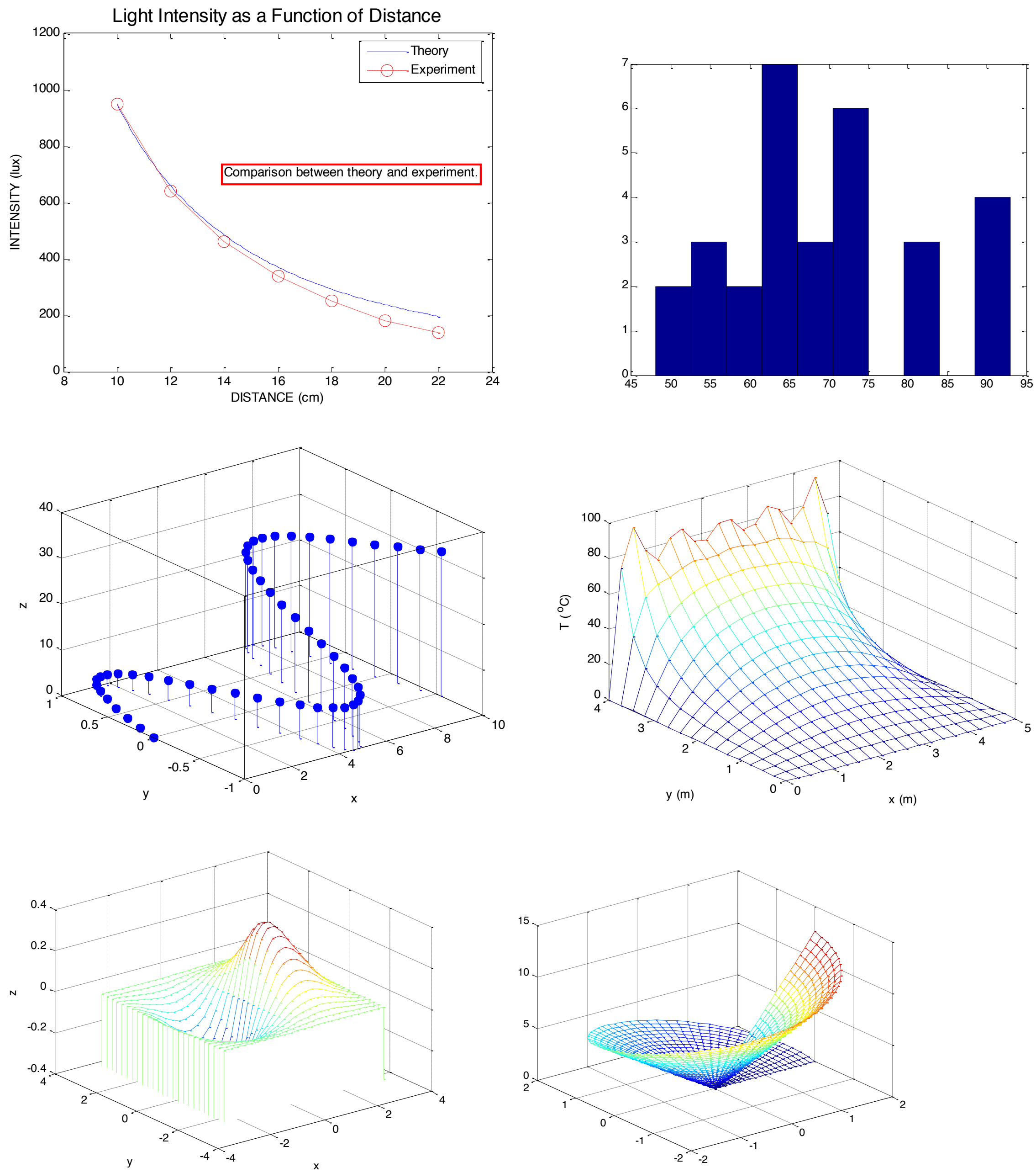


Fig.1a various physical simulation models and scientific computing with Matlab

Assess students: The aims of education (LCS) are expressed in terms of skills: analyze, perform, collaborate, communicate, etc. Knowledge and underlying skills associated with these various skills: the key is that the students at the end of the training year, to be able to solve simple problems speaking in terms of data or digital systems.

Table.1. Students Gender and Grade Level currently

	Male	Female	Total
undergraduate	25	85	110

Second cycle	20	40	60
Postgraduate in Phd	08	16	24

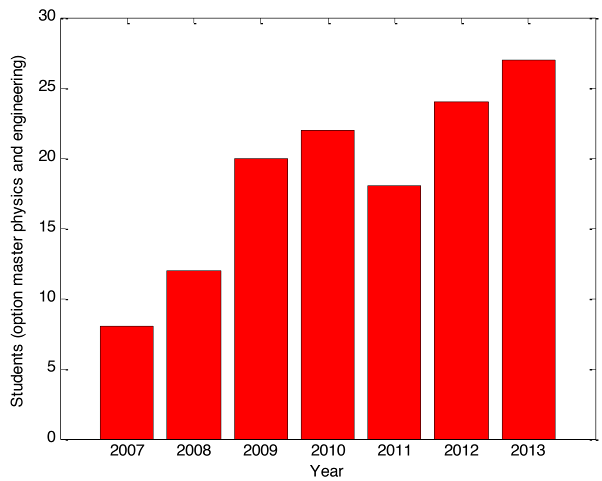


Figure 2 : development of students during the past 7 years in Master of Science

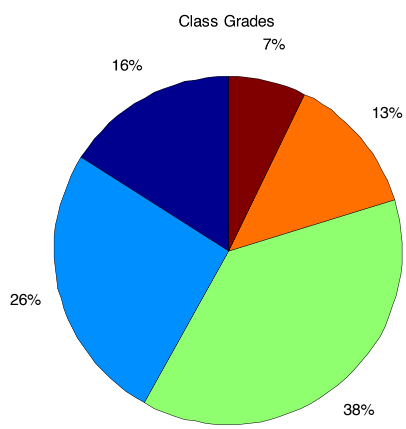


Figure 3. The table below shows the grades that were assigned to a class (Master 5e).

CONCLUSION This paper is a comprehensive optics text that has been written in a mode to encourage students to run the models, do the calculations and generate their own illustrations. This contribution would serve as an excellent text for undergraduate use and reference for laboratory simulation experiments." The physical sciences have so far benefited from the momentum of the Computer to plan everyone. Some teachers were able to identify and exploit its educational value. In addition to reflecting the reality of the scientific and industrial world, the computer can modernize the image of the discipline.

For students, the benefits are many: do science with material modern and powerful, save time to focus on the understanding of a problem, be able to manage their data acquisition and processing. For teachers, new opportunities open to him: to familiarize the student with abstract quantities, such as energy, by making him represent explore unlimited graphing and modeling, and finally have the opportunity to change his teaching during his career.
The introduction of the computer reflects the fact that the modern school still stands
to offer students a new teaching, closer to the reality that it will faces. The interest of the student must be central in the choice of computer use and investment of the teacher, complete. Now even in countries emerging opportunities offered for the resources are offered conveniently through anytime-anywhere web access throughout one's degree program and hence broadly impact students and faculty of a Numerical Methods course as well as of engineering courses where numerical methods and computational systems are used. It is free of charge to anyone in the world.

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BIOGRAPHICAL INFORMATION

MOHAMMEDI Ferhat, Ph. D. *is titular of a mathematical Master and D.E.A in photonics systems of the E.N.S.P.S of Strasbourg, Doctorate in mathematical physics of the University Louis Pasteur of Strasbourg. Currently, teacher-researcher, lecturer at the University of Biskra in Algeria. his research in optics measure 2D-3D and Engineering Education.*
http://cat.inist.fr/?aModele=afficheN&cpsidt=156663
Bensaada Said is a Professor in engineering sciences and mechanical of Education at University of Biskra, ,Algeria. His current research focuses on in the product development process, *Engineering Education.*
Bensaada52@yahoo.fr

Corresponding author

Mohammedi Ferhat
Departement of physique Institute of Sciences, 7000 Biskra B.P 145 R.P 07000-Biskkra ALGERIA
farwane@yahoo.fr