

## Visual Basic Applications to Physics Teaching\*

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Derived from basic language, VB (Visual Basic) is a programming language focused on the video interface component. With graphics and functional components implemented, the programmer is able to bring and use their components to achieve the desired application in a relatively short time. Language VB is a useful tool in physics teaching by creating educational programs with him. This study aimed to exemplify the applications used during training in physics by using VB programming language. To increase efficiency of teaching and learning, teaching and assessment strategies involve the use of diverse teaching methods. Also, differential treatment of students during the training process should be taken into account both their educational profile and the quality and level of language which are interpreted and presented in curricular contents. In this sense, this study presents the evaluation matrix of students' learning styles and computer programs for rapid determination of physical parameters. Advantages of using programs made with VB are that it shortens the time and develops interactive training component during phases of study and assessment of physical phenomena.

*Keywords:* physics teaching, educational profile, computer programs, VB (Visual Basic), teaching-learning-assessment

### Visual Basic Applications to Physics Teaching

The main objective of training is directed to form human personalities with operational skills required in various fields of activities. The teacher's role is to achieve target with maximum efficiency. For this, he/she must take into account not only the human components which interact, but also the adjacent materials component to the training environment.

On the human component, we must regard many typologies of individual students and educators involving in teaching-learning-assessment process (Cucos, 2006).

A genuine process of training will be initiated through a diagnostic test, highlighting the factors involved in education, educational profile of the sample of students and individual profile of each student. The results of these investigations will be indicators to consider using teaching strategies and most effective teaching methods (Malinovschi, 2003).

We consider that assessment of student learning styles is one of the starting points for identifying the skills and multiple intelligences of students (Gardner, 2006).

Data obtained from the application of tests and questionnaires with diagnostic role can be processed acceptable in terms of rigor, by introducing relatively simple mathematical models. The result of theoretical modeling is to develop a matrix for assessing students' preferred learning styles, matrix with diagnostic and

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analytical role.

The right software evaluation matrix is created in the programming language VB (Visual Basic), and corresponding interface is easy to be used by the teacher.

When investigating a relatively small group of subjects, such as a class of students can apply the results of determinations made in the assumptions category. There is an element rescuer for the correct application of statistics, namely the number of response items fell in the statistical sample. Learning style assessment practice has the advantage that is relatively independent of the nature of the discipline considered (Bostrom, Olfman, & Sein, 1990). Proposed analytical methods can be useful in this regard.

Training as a teaching process should consider diversifying teaching and learning methods, assessment and both the cognitive level and the action level. Framework of teaching laboratory experiment mixes theoretical and experimental content in a balance way. A differentiated instruction process is found in ordinary physics lesson and continues the themes of deepening and extending the concepts. Pedagogical strategies to the gradual increase in degree of difficulty in physics lessons may include alternative approaches as a mean of differentiated training (Florian, 2004).

To the groups of students interested in the study of physics can be grouped and arranged some physics experiments. In this regard, to determine the same physical parameters, experimental methods can diversify. Recall the alternative methods for measuring dynamic and static physical parameters, kinematics and energy alternatives methods or alternative methods that refer to extreme conditions that occur during the conduct of certain physical phenomena studied in laboratory.

Developing educational software requires continuous collaboration with pedagogical competence skills. Building a training environment based on computer requires pedagogical design and implementation of computer software and running into a concrete framework for learning, under controlled conditions (Miron, 2008).

Using the computer in classic laboratory experiment improves the quality of training physical discipline. In this sense, it can be made useful educational software for calculating certain experimental physical parameters. Using the VB, this software determines values of physical parameters in a short time and gives users information on the conditions imposed by the experiment in progress.

From programs which diagnose the cognitive acquisition or the student's educational profile, continuing with programs for calculating the physical parameters and ending with programs to assessment knowledge and practical skills, are particularly useful for a quality and interactive learning process.

The authors estimated that feedback training help partners in choosing teaching methods for which they have shown special skills. Physical discipline differentiated instruction causes feelings of involvement, engaging students' motivation to compete for personal and collective goals.

### **Theoretical Notions**

Computer-aided analysis of a phenomenon simplifies mathematical calculations, graphics development easier and reduces work time allowing students to focus on physical phenomena studied.

VB is a programming language produced by Microsoft, derived from basic language programming. It is widely popular because this program has the graphical interface that is available to the user. This interface is relatively simple to be done. Using Microsoft Visual Basic 2008 Express Edition can perform standard Windows-based interfaces, such as windows, buttons, lists, etc. (retrieved from <http://msdn.microsoft.com/en-us/default.aspx>). VB has also a library of visual components: lists, calendars, menus, etc., which has already

graphics and functional parts implemented. But the programmer is able to enter and use its components.

VB can be used to make simple educational software and achieve more complex applications such as computer games.

Application (project) is made up of (retrieved from <http://filelist.ro>):

- (1) Forms—windows that you create for user interface;
- (2) Controls—graphical features drawn on forms to allow users' interaction (text boxes, labels, scroll bars, command buttons, etc.), forms and controls are objects;
- (3) Properties—every characteristic of a form or control specified by a property. Example properties include names, captions, size, position and contents. VB applies default properties. You can change properties at design time or run time;
- (4) Methods—built in procedure that can be invoked to impart some actions to a particular object;
- (5) Event procedures—code related to some objects. This is the code that is executed when a certain event occurs;
- (6) General procedures—code not related to objects. This code must be invoked by the application;
- (7) Modules—collection of general procedures, variable declarations and constant definitions used by application.

There are three primary steps involved in building a VB application:

- (1) Drawing the user interface;
- (2) Assigning properties to controls;
- (3) Attaching code to controls.

After realized the software program, it can improve or modify both working on the interface and inside the main program.

Thus, you can make text changes to the interface program by opening solution file (.Sln) and acting on properties that correspond to appropriate forms in the project. Also, you can reposition the values associated to the text and font used in their writing.

To change into programs line, opens again solution file (.Sln) and used the instruction “View Code”. After the appearance of programs lines, we shall realize their corresponding modification and act the “Start Debugging” button from VB menu to check the program run. Finally, the project must be saved by acting on the buttons “Save All” and “Build” respectively, which are located in the menu bar from the VB program. This study aimed to present several programs conducted by platform Microsoft Visual Basic 2008 Express Edition, programs that are used during laboratory training in physics lessons (retrieved from <http://www.dreamincode.net>; <http://filelist.ro>).

### The Assessment Matrix of Learning Styles

Based on a mathematical model, performed quantitative analyses were to identify preferred learning styles of students in physical discipline.

The theoretical model defines measurable parameters that verify certain invariance equations (Kudryavtsev & Demidovich, 1981; Nastasescu, Nita, Andrei, Radutu, Vornicescu, & Vornicescu, 2002). Thus, all parameters are introduced:

- (1) Index of competence in relation to a particular learning style (visual, auditory and practical)

$$i_{N(v)} = \frac{n_v}{n_v + n_a + n_p} \quad , \quad i_{N(a)} = \frac{n_a}{n_v + n_a + n_p} \quad , \quad i_{A(p)} = \frac{n_p}{n_v + n_a + n_p} \quad ;$$

(2) Multiplication-index of learning styles in the selected sample

$$m_N = \frac{n_v + n_a + n_p}{N};$$

(3) Multiplication-index specific to a particular learning style

$$s_{N(v)} = \frac{n_v}{N} \quad , \quad s_{N(a)} = \frac{n_a}{N} \quad , \quad s_{N(p)} = \frac{n_p}{N}.$$

Analysis of preferred styles of learning and learning conditions to increase efficiency was introduced by a matrix of assessment.

Corresponding software evaluation matrix was developed with Visual Basic 2008 Express Edition program.

Using the interface created, the user assigns values to variables and the corresponding matrix displays as soon as the parameters of interest.

Further processing of these parameters leads to interpretation of results and conclusions training.

For a good functionality, GUI (Graphic User Interface) contains buttons with roles: reset, save and calculate (retrieved from <http://msdn.microsoft.com/en-us/default.aspx>).

Assigning new values to variables of program will act on "RESET" button and saving the "image" matrix in an Excel file will act on the "SAVE" button. If the data entered by the user are incorrect, the program displays warning messages like: "Impossible to calculate because the amount of skills has to be at least equal to the number of subjects for each sample".

### **The Limit Angle Method and the Minimum Deviation Method for Determining the Refractive Index of an Optical Prism**

Keeping differentiated instruction method of students, the teacher may propose alternative experimental methods for determining the same physical parameters.

Thus, determining the refractive index of glass can be chosen to line the limit the angle method to total reflection phenomenon of light (see Figure 2) and the minimum deviation method of light across the optical prism to refraction phenomenon (see Figure 3).

Mathematical relation for calculating the refractive index for a homogeneous optical medium to the total reflection of light phenomenon is:

$$n_{glass} = \frac{1}{\sin l}$$

and to the minimum deviation of light phenomenon is:

$$n_{sticla} = \frac{\sin \frac{\delta_{min} + A}{2}}{\sin \frac{A}{2}}$$

Using VB 2008 Express Edition Program has made software corresponding to these experiments. Values of the refractive index are calculated and these values are displayed via graphical interface.

Also programs run on constrained input variables, displaying warning messages if the experimental measurement errors exceed a certain threshold value.

These messages can be for an example: "The Limit Angle,  $l$ , FOR The Glass-air Refraction Phenomenon Cannot be Below 38 Degrees" or "The Minimum Deviation Angle,  $\Delta_{min}$ , Cannot be Above 50 or Below 30 Degrees!".

## Experimental Results

Interactive educational software was used during the training process to physics discipline (Miron, 2008). Software interfaces have been used successfully by students and teachers. Theoretical contents were complemented by experimental results.

### The Experimental Results Obtained to the Assessment Matrix of Learning Styles

Figure 1 shows the image of assessment matrix interface. This includes parameters, such as “number of subjects”, “visual competences number”, “auditory competences number”, and “practical competences number”. Variable belonging two subgroups A and B from N samples has been studied.

Sample Name	Number of subjects	Visual competences number	Auditory competences number	Practical competences number	Total competences number	Competence index			Multiplication index	Specific multiplication index		
						Visual	Auditory	Practical		Visual	Auditory	Practical
A	143	101	135	41	277	0.3646	0.4873	0.1480	1.9370	0.7062	0.9440	0.2867
B	168	39	132	110	281	0.1387	0.4697	0.3914	1.6726	0.2321	0.7857	0.6547
N	311	140	267	151	558	0.2508	0.4784	0.2706	1.7942	0.4501	0.8585	0.4855
$S_{A(v)} + S_{B(v)}$	-	-	-	-	-	-	-	-	-	0.9384	-	-
$S_{A(v)} + S_{B(v)}$ MAX	-	-	-	-	-	-	-	-	-	2.000	-	-
$S_{A(a)} + S_{B(a)}$	-	-	-	-	-	-	-	-	-	-	1.7297	-
$S_{A(a)} + S_{B(a)}$ MAX	-	-	-	-	-	-	-	-	-	-	2.000	-
$S_{A(p)} + S_{B(p)}$	-	-	-	-	-	-	-	-	-	-	-	0.9414
$S_{A(p)} + S_{B(p)}$ MAX	-	-	-	-	-	-	-	-	-	-	-	2.000

Figure 1. The image capture of graphical interface to the assessment matrix of students learning styles.

Each button belonged to GUI is implemented by logic programming and the user is not interested in lines of code that are “behind” the interface.

Depending on the values calculated for the indicators introduced by the mathematical model, the user can deliver value judgments on the diagnosis and evolution of students’ behaviors on preferred learning styles (Fritzsche, 1976).

### The Experimental Results Obtained to the Limit Angle Method and the Minimum Deviation Method for Determining the Refractive Index of an Optical Prism

Images obtained during alternatives experiment for determining the refractive index of optical prisms are shown in Figures 2 and 3.

The image described in Figure 2 shows that the incident laser beam is directed so as to produce the phenomenon of total reflection of light. Also, the image that correspond to Figure 3 shows that the incident laser beam is passing through the optical prism by parallel direction with base of the prism. In Figures 4 and 5 respectively, there are examples of images of graphical interfaces corresponding to programs made in VB (retrieved from <http://filelist.ro>). These images were obtained during alternatives experiments for determining the refractive index of optical prisms.

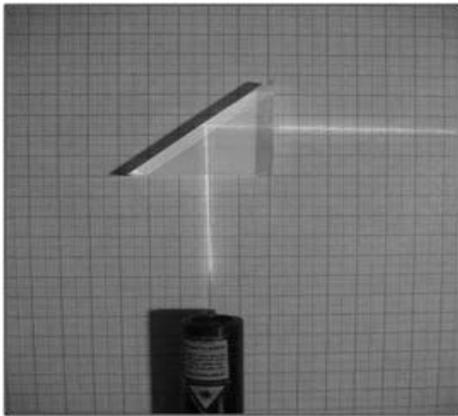


Figure 2. The experimental device in total reflection phenomenon of light.

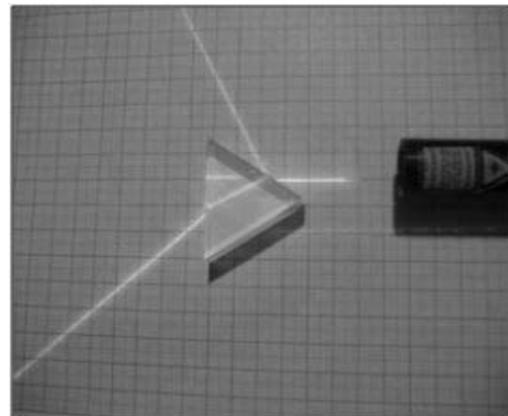


Figure 3. The experimental device in minimum deviation phenomenon of light.

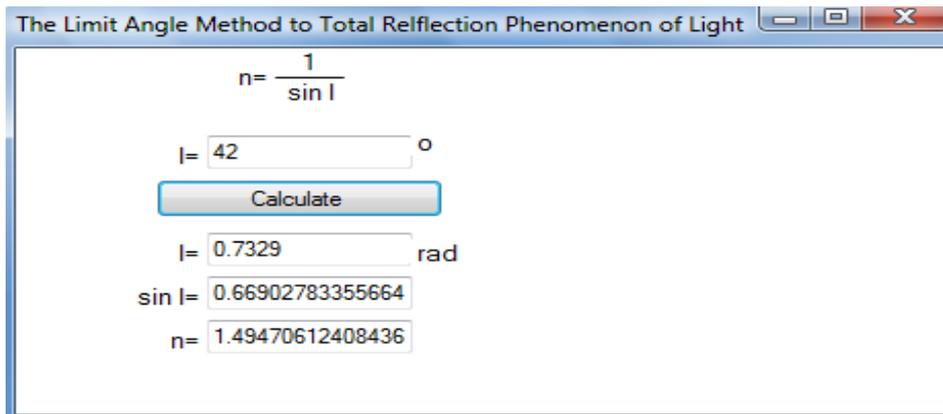


Figure 4. Image capture of GUI to total reflection of light phenomenon.

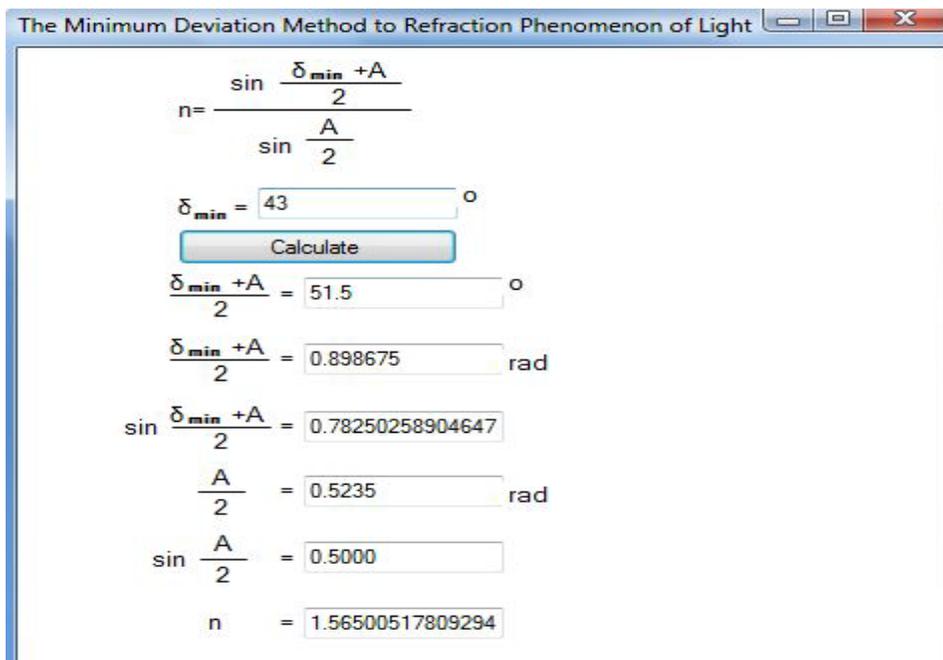


Figure 5. Image capture of GUI to minimum deviation of light phenomenon.

GUI on the laboratory scientific experiment offers students information on values and the order of magnitude of physical parameters measured.

### Conclusions

In order to obtain a good correlation among objective, items and performance indicators, it can develop educational software that can be based on teaching scenarios. The goal was to identify the essential contents of each lesson time, emphasizing appropriate learning items, which implements the operational objectives of the lesson.

In order to achieve an operational objective, appropriate learning items were considered those that:

- (1) Covering specific learning difficulties that occur when materials are taught traditionally;
- (2) Providing an understanding of physical meanings and terminology;
- (3) Raising and maintains students' interests.

Introduction of educational software can increase students' interests in the visual style of learning, and therefore, increase the efficiency of the teaching-learning assessment. Also, the consequences of using educational software are the developing of the digital skills and practical skills.

Whatever the methods are used by means of learning strategies, the school performances can be improved by employing a differentiated or individualized treatment to the themes of study and units of learning.

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