Students Perception Regarding the use of Virtual Instruments in Teaching and Learning Process

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In addition to the use by students of laboratories and hands-on learning, teaching-learning can be improved by using Virtual Instruments. A questionnaire was administered to find the students' opinion on the use of virtual laboratories to facilitate the understanding of the phenomena and to eliminate some disadvantages of the real laboratories.

Keywords: *virtual instruments, Java applets, learning*

1. Introduction.

To improve the teaching and learning process of different engineering disciplines, virtual instruments are used. These are also used in other disciplines, where real laboratories contribute to the learning process of students [1-5]. However, because sometimes it requires complex and expensive equipment, it is not possible to carry out some experiments; these virtual laboratories come to the aid of the students and can eliminate these disadvantages.

In addition to using virtual instruments in biology, physics, chemistry, they can also be used in mathematics to support engineering students who can thus use or build virtual instruments [6] or understand some phenomena using Java applets [7-8].

The use of visual tools in graphical representations of histograms, sinc functions for damage assessments or for accurately evaluate the natural frequencies, is presented in [9-11].

This paper presents a Java applet which, in its easy-to-use way, allows teachers to involve it in teaching and facilitates the understanding of exposed phenomena. In order to find the students' opinion regarding the use of the virtual laboratories, a questionnaire was given and the results obtained are presented in this paper.

2. Using Virtual Instruments

The Java Applets on Physics used in this study permit depicting the variation of elongation, velocity, and acceleration, along with the energy transformation during the free vibration of an undamped spring pendulum.
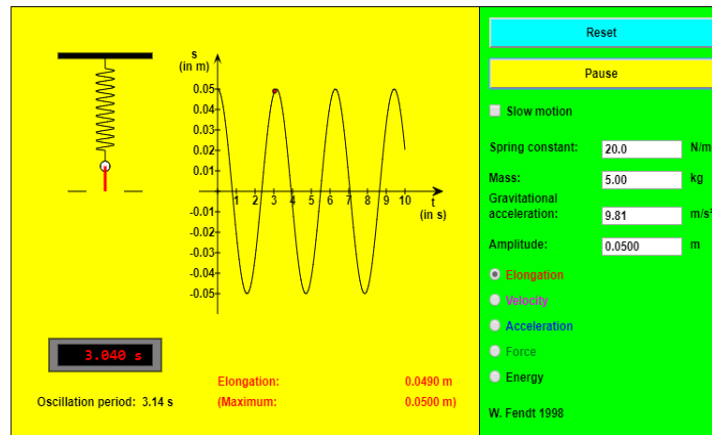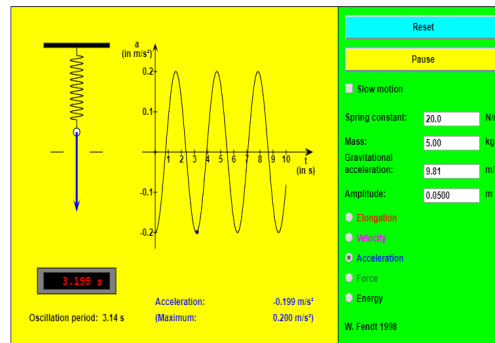

Figure 1. The elongation diagram

Acting the "Reset" button, the pendulum body returns to its initial, steady position. The students can stop or continue the simulation with the "Pause" button. For a slower movement they can choose "Slow motion". The spring constant, the mass and the amplitude of the oscillation can be modified very easily with this interface within certain limits [13].
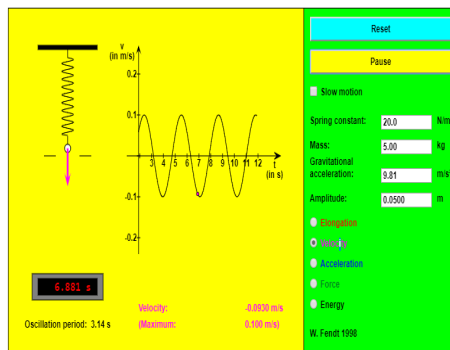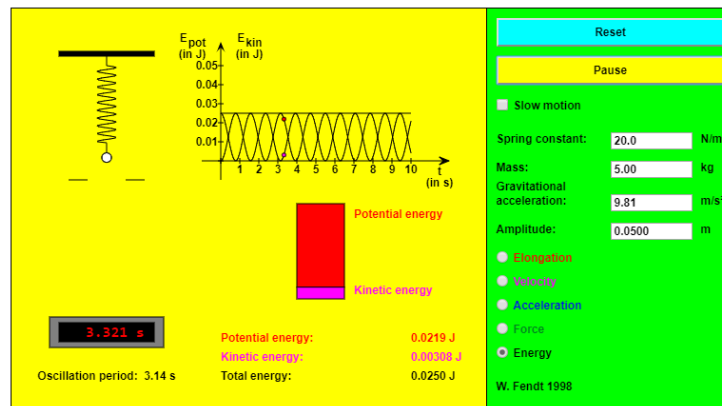

Figure 2. The velocity diagram

Figure 3. The acceleration diagram

53

In Figures 1, 2 and 3 we have shown the diagrams for elongation, velocity and acceleration variation in time.

Figure 4. The potential energy, the kinetic energy and total energy diagrams

The two energies, the potential energy and the kinetic one, are periodic functions of time, having equal amplitudes. The period of variation of kinetic energy and potential energy is half of the oscillation period T. When the potential energy achieves maxima, the kinetic energy is minimal and vice versa. When the kinetic energy increases, the potential energy decreases, and vice versa. Their sum, which represents the mechanical energy, remains constant over time. Figure 4 shows us the potential energy, the kinetic energy and the total energy variation in time.

3. Analysis of student perceptions regarding the use of Virtual Instruments

We conducted a study on students' opinion on the use of Virtual Instrumentation. 40 students attended this research. Students evaluated their experience using Likert-scale ratings (1- Strongly disagree, 2- Disagree, 3- Neutral, 4- Agree and 5- Strongly agree). Based on the responses received from each student, graphs were drawn in which their answers were highlighted in percentage.

1. Were you familiar with the Java applets when you started your activities at this discipline?
      a. from another discipline which uses virtual instrumentation
      b. from thematic students' scientific circles
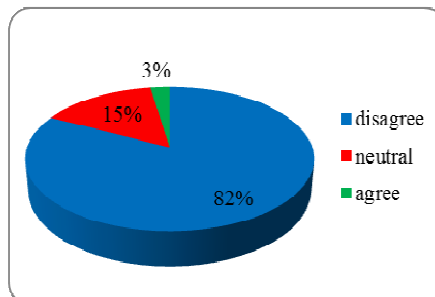   c. autodidact.

Table 1. Answers to the first question

Nr. of question	strongly disagree	disagree	neutral	agree	strongly agree
1a.	5	28	5	2	0
1b.	0	27	5	8	0
1c	0	33	6	1	0
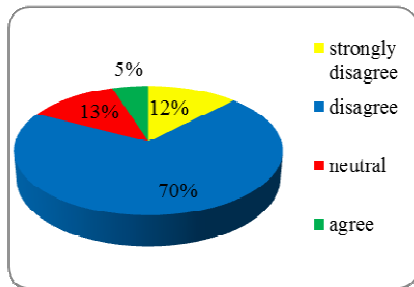
Figure 5. Answers to the question 1a.
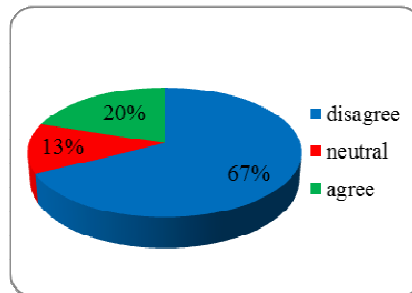
Figure 6. Answers to the question 1b.

Figure 7. Answers to the question 1c.

As can be seen from the responses received, only 11 students have used java applets to another discipline (2), student scientific circles (8) or as autodidact (1).

For the following three questions
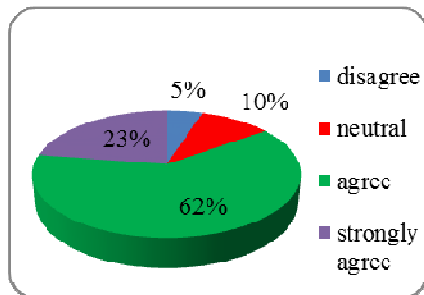2. Is the applet interface friendly and easy to use?
3. Beside classroom materials did you need help, manuals or supplemented information to use this java applets?
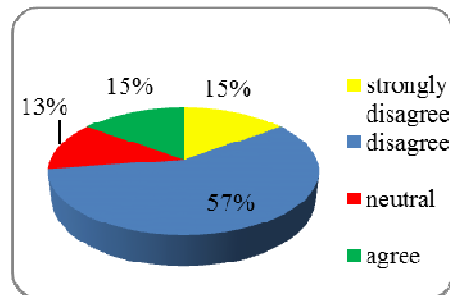4. Interpreting the obtained results is easier using this Virtual Instrument?

The answers are synthesized in Table 2.

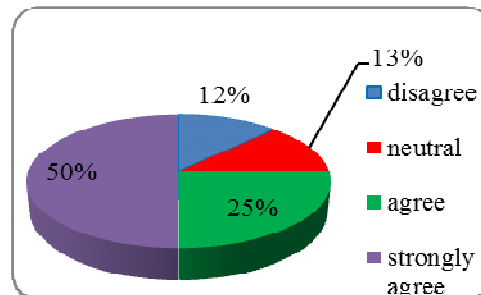**Table 2.** Answers to the next three questions

Nr. of question	strongly disagree	disagree	neutral	agree	strongly agree
2	0	2	4	25	9
3	6	23	5	6	0
4	0	5	5	10	20

Figure 8. Answers to the second question


Figure 9. Answers to the third question

Figure 10. Answers to the fourth question

Most students who participated in this study agreed that the applet interface is friendly and easy to use (23% strongly agree and 25% agree) and using this Virtual Instrument was very easy to interpret the results. They said, in a proportion of 73%, that besides class materials they did not need additional information to help them use this applet.
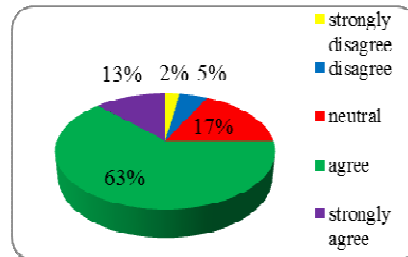
5. What is the advantage of using this applet?
a. visualization of results
b. possibility to perform virtual experiments independent of time and space
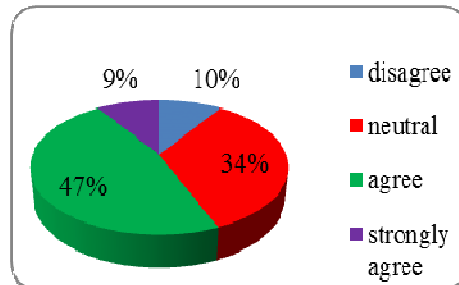c. test theory in practice

Table 3. Answers to the fifth questions

Nr. of question	strongly disagree	disagree	neutral	agree	Strongly agree
5 a	0	2	3	25	10
5 b	1	2	7	25	5
5 c	0	3	11	15	3
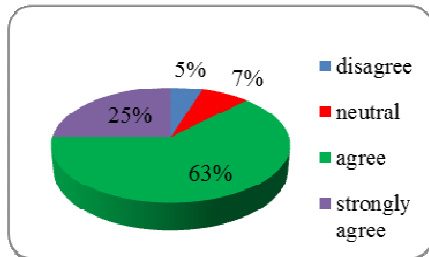
Figure 11. Answers to the question 5a.
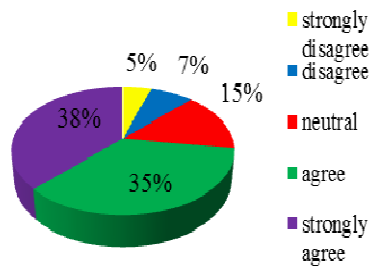

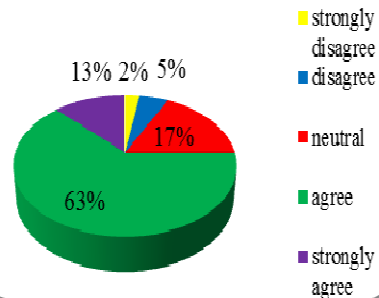**Figure 12** Answers to the question 5b
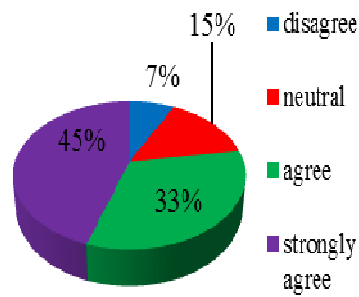

Figure 13. Answers to the question 5c.

6. For what do you consider this virtual instrument useful?
a. to complete the knowledge achieved from theory by courses and seminaries
b. to complete the knowledge achieved from real laboratory experiments
c. to integrate it more intensively in real laboratory facilities and equipment

Figure 14. Answers to the question 6a.   **Figure 15.** Answers to the question 6b.

Figure 16. Answers to the question 6c.

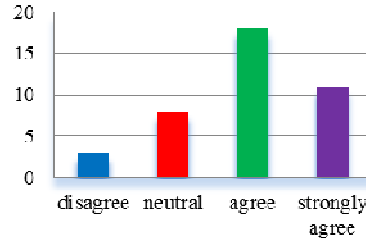7. Your knowledge in the field of vibration have been improved by using this applets?

8. The use of Virtual Instrument's provided experience which will be valuable in your future career?

Table 4. Answers to the 7 and 8 questions

Nr. of question	strongly disagree	disagree	neutral	agree	strongly agree
7	0	3	7	16	14
8	0	3	8	18	11

58
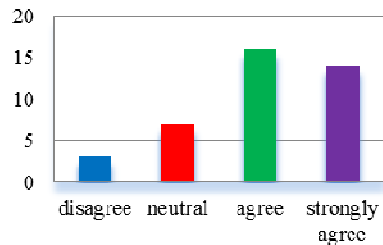
Figure 17. Answers to the question 7.   **Figure 18.** Answers to the question 8.

Strongly agreed are 35% of respondents and 40% agree that their knowledge has improved with the use of this applet and 70% of them believe that using these virtual instruments offers them experiences that will help in their future career.

4. Conclusion

Using Virtual Laboratories can eliminate the drawbacks of using classical laboratories. For using these virtual labs, it is not necessary to use sophisticated or expensive equipment.

In order to better understand the phenomena described, students can use these Java applets, both at school and at home, as a very good tool with which they can improve their learning process.

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