

SOCRATES PROGRAMME
Education, Audivisual and Culture
Executive Agency
European Commision,
BOUR - B-1049 BRUSSELS



DESCRIPTION OF MODULE (SCHEDULE)

MODULE	USING THE LABORATORY TO ENHANCE STUDENT LEARNING AND SCIENTIFIC INQUIRY
<i>Volume of module (credit, hours)</i>	Two credits, 2 contact hours(Direct Lab Teaching) + 2 hours individual study. Total duration 28 weeks(for two semester)
<i>The brief description of the module</i>	<p>The laboratory has been given a central and distinctive role in science education, and science educators have suggested that rich benefits in learning accrue from using laboratory activities.</p> <p>We are living in an era of dramatic new technology resources and new standards in science education in which learning by inquiry has been given renewed central status (Hofstein & Lunetta; 2003).</p> <p>This module has focused on the questions how science laboratory resources are used, how students’ work in the laboratory is assessed, and how science laboratory activities can be used by teachers to enhance intended learning outcomes, current models of how students construct knowledge, information about how teachers and students engage in science laboratory activities.</p>
<i>Competencies to be achieved</i>	<ul style="list-style-type: none"> ▪ to know the steps of scientific process, ▪ to understand science content, ▪ competency to explain the nature of science, ▪ competency to explain the causes , results and correlations of scientific events meaningfully, ▪ to develop concepts and relationships from observations and to infer from them scientifically. ▪ to be aware of alternative experiments of the same event.
<i>Goals of studies</i>	<ul style="list-style-type: none"> • to improve prospective teachers’ understanding of science concepts; • to foster a learning environment supporting conceptual

	<p>understanding;</p> <ul style="list-style-type: none"> • to promote positive attitudes toward learning and teaching science (biology, chemistry and physics in particular). • to improve the nature of science • to improve scientific process skills
<i>Content of module (topics)</i>	<ol style="list-style-type: none"> 1. Constructivist science and lab education resources. 2. Constructivist science teaching techniques (such as conceptual change approaches, analogies, text etc.) 3. Scientific process skills 4. Meaningful learning, nature of science etc. 5.
<i>Strategies of teaching / training</i>	<ul style="list-style-type: none"> • Team work, discussion, individual work. • Cooperative learning techniques (not only student-student interactions but also student-teacher interactions) • Constructivist lecture– constructivist laboratory type approach, • Conceptual change approaches (using analogies, modelling...) • Inquiry-centered approaches; • Cognitive and interactive approaches.) <ol style="list-style-type: none"> 1. The student is involved actively and assumes responsibility for his or her own learning. 2. The preconceptions of the students are obtained by various methods, for example, teacher asking questions after the students have a chance to explore with materials or consider a problem. Students are asked to generate questions, predictions, explanations. 3. Problems are posed by the teacher to create dissatisfaction with the learner’s present knowledge. 4. Work is performed in groups or teams. Discussion within the group is required. Teams report to class. Work is criticized by other groups. Groups report out and make presentations to the class. 5. Additional applications are sought by the students (as in NSES).
<i>Distribution of hours of the module</i>	<p>Theoretical works – 14 hours Practical works – 28 hours Home work / Individual project ect. – 12 hours Self-studies 28 hours Total: 82 hours (for one semester)</p>
<i>Final evaluation criteria</i>	<ul style="list-style-type: none"> • Quality of experimenting • Quality to explain cause, results and correlations of related concepts. • Ability to work in the group.
<i>Strategies and technics of</i>	<ul style="list-style-type: none"> ■ Performance tests: %40 * Through asking open ended questions before and after or

<p><i>evaluation of achievements</i></p>	<p>doing experiments (Real life problem solving situations, scientific reasoning, to suggest similar alternative experiments etc).</p> <ul style="list-style-type: none"> ■ Experiment reports (%20) Checking the reports of the student recorded about the every experiment. ■ Final exam: % 40
<p><i>References (main sources)</i></p>	<ol style="list-style-type: none"> 1. National Research Council (NRC) 1996 Washington DC National Academy Press. 2. Posner, Strike, Hewson, Gertzog, 1982, Science Education, Vol 66. 3. Colburn, A. 2000. Constructivism: Science Education’s “Grand unifying theory”, the Clearing House September/October pp 8-12. 4. Liang and Gabel D, 2005, Effectiveness of constructivist instruction to science instruction for prospective elementary teachers. Int. J of Sci. Educ. 27, 10, pp 1143-1162. 5. Hofstein, A; Lunetta V.N. 2004 , The Laboratory in Science Education: Foundations for the Twenty-First Century <i>Sci Ed</i> 88:28 – 54, 2004; 6. ...