



On the Education in Physics and Astrophysics

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Could we educate future soft engineers in 21st century, Digital Age with Pedagogy from mostly middle centuries?

My own practice

- ❖ General Physics: 2 years, 4 semesters
- ❖ Lectures, problem solving, work in laboratory
- ❖ Introduction: to inspire and motivate students
 - ❖ Interests in sciences, research, learning, carrier
 - ❖ Presentation of international scientific projects and missions: solid knowledge in physics to be good engineer, many opportunities for education, specialization, research, work and carrier
- ❖ Lectures: in a dialog regime, questions and analysis to rediscover the physical phenomena and experiences, concepts, explanations, examples, exercises, problems, solving problems, conclusions - together
- ❖ Active learning: learning in doing
- ❖ More Astronomy: Universe – the biggest Laboratory for small and large scale phenomena
- ❖ Continues assessment during the semester
- ❖ Some attempts to involve the students in research
- ❖ Guided and no guided learning: most students prefer guided learning
- ❖ Individual work and collaboration in small groups: most students prefer copy paste
- ❖ Stimulation, encourage for participation in events of popularization of science
- ❖ Some of my observations: **no pencil, no paper** → applying technology
- ❖ Conclusion: it is not enough!

What is it today?

- ❖ More illiterate young people
- ❖ More aggression at school
- ❖ We loose their time
- ❖ The education process does not stimulate the curiosity and learning
- ❖ The education process (and other factors) repel the students from learning, reading, Natural Sciences and Engineering
- ❖

What missing?

- ❖ The leading role of the government
- ❖ Education: priority of the society and of the government
- ❖ Education: at the focus of the government
- ❖ Need of: policy, strategy, framework, program, ... on the Education system, education process, ...
- ❖ Coherence in programs of primary, secondary, high and higher education grades: both, within one science and between different sciences
- ❖ Deep revising, analyzing and changes of goals, content curriculums, programs, teaching and learning methods, pedagogy, assessment, ...
- ❖ Stimulating participation in research
- ❖ The leading role of learning institutions

Physics Education Research

- ❖ Teaching in Physics – Art or Science?
- ❖ Subfield of Physics and Astronomy
- ❖ Physicists engaging with education as a subject of scientific research
- ❖ It is fundamental and foundational research
- ❖ It is focused onto how the students understand and use the concepts of physics, understanding and improving learning
- ❖ Explores a rich array of cognitive and social phenomena
- ❖ Include modification of instructions to increase the educational efficacy, alternative process
- ❖ Founder of PER is Lilian McDermott from University of Washington
- ❖ Meetings since 1994
- ❖ Communities: International Conference on Physics Education, American Association of Physics Teachers, International Commission on Physics Education, Network of Physics Education Groups in USA, one group in Edinburgh
- ❖ Collaboration: Science Education, Education Psychology, Linguistics, Cognitive Sciences, Anthropology, etc.
- ❖ Trend of research: conceptual understanding, epistemology, problem solving, attitudes, social aspects, technology
- ❖ Specific Instructional Innervations: education impact of different pedagogy
- ❖ Instructional materials
- ❖ Follow the *Framework for K–12 Science Education*

Next Generation Science Standards



<http://www.nextgenscience.org/>

“for Today’s Students and Tomorrow’s Workforce”

Framework for K–12 Science Education developed by the National Research Council

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