Canadian Association of Physicists
Association canadienne des physiciens et physiciennes

Contribution ID: **4445** Type: **Oral (Non-Student) / Orale (non-étudiant(e))**

Teaching Physics through brain imaging: case study of a cegep level project-based course

Monday 27 May 2024 16:45 (15 minutes)

Project-based courses have a huge pedagogical potential. They provide an opportunity for students to integrate knowledge acquired in previous courses, and in various disciplines. By working on a project over a few months, students can inquire, formulate plans, hypothesize, develop and evaluate solutions. They have to make some decisions on the information that should be acquired and how to apply it. The process leads them toward a deeper understanding of concepts and principles necessary to realize the project.
This talk will look at the case study of a course I developed in the last five years, aimed at introducing cegep students to the world of multidisciplinary research. It is given in the last semester before entering university and intertwines physics, chemistry, biology, math and psychology in projects studying brain behavior. The students went through the complete process of an experiment: literature search, choice of research question and hypothesis, writing of a letter of informed consent and design, execution, analysis, and dissemination of the results of the experiment. To captivate their interest over a full term, they were given some control on the choice of project and on the way to proceed. However, as they had never done anything this extensive before, they needed a fair amount of guidance. A structured framework was designed to lead them through the several steps of the process. In teams of three or four, they investigated a hypothesis of their choice involving a cognitive process by using a behavioral task and a simple and portative system recording electroencephalograms. In so doing, they learned about the production and transmission of electric fields in the brain and how it relates to the cognitive process studied. They tested their hypothesis on some thirty to sixty participants, usually other students from the cegep.
This presentation will focus on the learning of physical concepts, their relation to the chemistry and physiology of the brain and their application in a realistic situation. It will describe some best practices that were developed to "teach"this course. The course has been given five times so far and has been refined each time. Hopefully, these best practices will inspire other professors interested in a holistic approach to physics education.

Keyword-1

project-based course

Keyword-2

multidisciplinary research

Keyword-3

brain imaging

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Session Classification: (DPE) M3-5 Novel Topics, Teaching Technology, and Labs | Nouveaux sujets, technologie d'enseignement et laboratoires (DEP)

Track Classification: Technical Sessions / Sessions techniques: Physics Education / Enseignement de la physique (DPE-DEP)