**How we Solve Problems and Create Value:**

**The Scientific Method and the NABC**

Draft Version 1: 12/11/2017

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**Lesson Description**

This is an introduction to the general *process* of “how science is done” and the “how business/industry innovates”. The typical physics curriculum focuses on the knowledge and critical thinking skills use to solve physics problems and does not identify the advantages these bring to the business world that allow physics students to thrive. The creative processes used in solving physics problems maps well to innovation practices in business and industry. Physics students certainly do not recognize these connections and this introductory session will narrow this gap and illustrate that physics provides a strong foundation for innovation and entrepreneurship.

In this activity, the “Scientific Method” is compared to the SRI International Inc. NABC model (described in the materials) to demonstrate that both are intended to ***create value*** in society and have many parallels in their approaches to problem solving (or creating value). This will provide students with a basic overview of how science and business/industry are ***similar***. A learning outcome is for students to recognize that scientific critical thinking skills map to business/industry settings, and hence career training outside of academia. The NABC method will also enhance the student’s scientific approach to problem solving.

This lesson is intended as an approximately a ~20-40 minute period during a regular class meeting and is interactive/collaborative (the more interactive, the more time). This module was piloted in and First Year Physics Seminar course that met once a week. The activity incorporates student discussions or reflections on potential career pathways (become an Astrophysicist, get a job with a company as a scientist or engineer, create a start-up company, …), however, it could be done as a stand-alone introduction that connects the practices/functioning of any science to business/industry (i.e. introductory science course), or as part of a senior project. The instructional strategy includes students collaborating in groups to develop a simple model of how science and business/industry function/work and to identify similarities and differences. Following this, the instructor will review that ‘generic’ scientific method and the general details of the NABC process. A discussion of ***value*** summaries the activity by reflecting on the outcomes of the students’ discussion.

**Target Audience**

STEM majors at any level. This was piloted in a First Year Seminar Course for physics majors at was titled “Frontiers and Opportunities in Physics” that met once a week during the student’s first semester on campus.

**Prerequisites**

None. This introduction is a career exploration activity and/or an early activity in a project/problem-based course. Developed for a first year seminar course for physics majors, this activity could be used at any level as an introduction, for instance, at the beginning of a senior project course in creating a proposal for the project.

**Learning Objectives**

1. Students (working in a group) will be able to list and define the steps of the Scientific Method and how business operates. (No assignments are due for this as this is intended to utilize their current views of each).
2. Students will identify and express similarities and differences between the two processes within the group and then as a class.
3. Demonstrate the use of the NABC method to address a scientific problem.

**Evaluation**

This particular lesson does not have individual assessment/evaluation. The brainstorming was done on the classroom boards and photos were taken to analyze the outcomes of the brainstorming (to learn about the student’s knowledge and perceptions). The lesson could lead into an ‘elevator pitch’ session what would prepare a pitch for a value proposition (solution to a problem) based on the NABC process.

**Materials and Resources**

*List the tools and resources that are used by the instructor and learner to conduct and complete the lesson. Needs to be updated and expanded.*

* *Instructor Resources – PowerPoint Slides and lesson plan with notes.*
* *Learner Resources – Article handouts for post-lesson reading, reflection, and assignment.*
* Book: *Innovation: The Five Disciplines for Creating What Customers Want Hardcover*, by Curtis R. Carlson,‎ William W. Wilmot, Crown Publishing Group, 2006.

***Lesson Plan Outline***

**Estimated Time:** 25-40 minutes (could be shorter)

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| **Learning Objective** | **Activities/****Learning Method** | **Instructional Materials** | **Estimated Time** |
| Identify processes in the scientific method and how a business operates.  | The instructor opens the session by asking student groups (3-4 students each) the processes they have used in the past to solve scientific problems (i.e. high school science fairs, labs, or other examples…). They sketch this on a chalk/white board. The same is done with their perception on how a business is operated.  | None. This is done at the beginning based on students’ experiences and perceptions. | 10-15 minutes (monitor group work and provide feedback) |
| Match the similarities and express the differences for each process. | The instructor and students summarizes students the key features. This can be done within their groups first and then each group reports out with the instructor as a moderator.  | None. | 5-10 minutes |
| Review and explain the scientific method and NABC method. | The instructor presents PPT slide on each process on organizes illustrates the connections to the students work.  | PPT slide deck | 10-15 minutes |
| Apply the NABC method to a scientific problem (or their project)  | Reflection and homework assignment. | Submitted on the Learning Management System as a homework assignment. | 30 minutes outside of class. |