Writing a Levels-of-Inquiry Learning Sequence for High School Physics
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Writing a Level-of-Inquiry learning sequence is part and parcel of the unit design process. While unit plans deal with a wide array of things such as alternative conceptions, safety concerns, supplies and other resources, the learning sequence is at the heart of the instructional design process. In this three-class activity, we will work together to prepare "from scratch" a new learning sequence dealing with *Circular Motion & Gravitation*.

LEVELS OF INQUIRY FRAMEWORK:

The learning sequence we compose will incorporate the following structure taken directly from Levels of Inquiry:

Discovery Learning - Students develop concepts (and learn the names for new concepts) based on first-hand experiences.	**Interactive Demonstration** - Students are engaged in explanation and prediction-making that allows teacher to elicit, identify, confront, and resolve alternative conceptions.	**Inquiry Lesson** - Students identify scientific principles and/or relationships by working with a teacher who demonstrates the inquiry process and uses a "think aloud" protocol throughout.
Inquiry Lab - Students, working primarily on their own, establish empirical laws based on measurement of variables under controlled conditions.	**Real-world Applications** - Students solve problems related to authentic situations while working individually or in cooperative and collaborative groups using problem-based and project-based approaches.	**Hypothetical Explanation** - Students develop and test hypotheses that serve as tentative explanations for observed phenomena and guides for further experimentation.

POINTERS:

Students must realize that writing a learning sequence is a recursive process. That is, one will likely have to go through it time and again to get it right. What might at first seem to be a good idea under one Level of Inquiry might later be moved to another heading. As a result, the way that idea is taught will change.

Students must realize that learning sequences emphasize hands-on, minds-on activity. The students gather information and draw conclusions for evidence. The emphasis of the learning sequence is on what students do rather than on what teachers do. Recall that teaching does not necessarily result in learning.

Student should keep in mind that boundaries between various level of inquiry are not hard and fast, and that ideas and approaches often slowly merge into one another. Students should not labor under the false impression that the same amount of time must spent at each level. Some levels, depending on the topic, might pass in just a few minutes where others could take several class periods.

The general shift in locus of control and intellectual complexity should continue. No level of inquiry should be skipped without a solid intellectual basis for doing so. If a topic does not provide for hypothetical explanation, that may be deleted as part of the learning sequence; not all topics lend themselves equally to hypothetical inquiry.

Students should assume the existence of prior knowledge when teaching this learning sequence. For instance, students will likely have studied the following areas of physics prior to *Circular Motion & Gravitation:*

- *Kinematics: Multiple Dimensions*
- *Dynamics: Motion and Force*

In this class project, the instructor will serve as a guide. However, students will be expected to bring intellectual resources to bear in the creation of the learning sequence. Think about hands-on teaching tools, demonstrations, ways of promoting inquiry, lab activities, problems, and prospects for hypothetical inquiry before coming to class. Consider looking up internet resources in the teaching of the topic under consideration.

GENERAL PROCECURE:

1. Identify the concepts of the unit *Circular Motion & Gravitation.*
2. Identify broad educational goals of the unit. That is, what in general are students expected to know and be able to do at the end of the unit? (Don't confuse goals with student performance objectives which are much more detailed.)
3. Brainstorm activities that will be used to teach the identified concepts.
4. Record any questions that might lead to future inquiry-oriented activities.
5. Place brainstormed activities in the Levels of Inquiry framework.
6. Identify levels where there might be an "overabundance" and "deficit" of activities and find new activities that might be added to fill any gap. If not, which associated activities in adjacent framework cells might be redistributed and taught differently.
7. Review the learning sequence regularly. Are things in appropriate order moving from less intellectually complex to more intellectually complex? Are prerequisite knowledge requirements being met? If not, how can this be remedied?
8. Is the locus of control shifting from teacher directed at the start to student directed toward the end?
9. Repeats steps six and eight until the framework is completed to your satisfaction.
10. Once the framework is complete, detailed planning for instruction can begin (which will not be addressed in this activity).