1 Instructor's Guide

1.1 Introduction

- If you haven't yet done so, this is the time to introduce the vector surface element $d\vec{A} = \hat{n}\ dA$. Point out that the only unique direction related to a surface (in three dimensions) is the normal to the surface.
- Start with the [[swbq:emsw:vfswflux|Recall Definition of Flux]] SWBQ. This SWBQ is an opportunity for the instructor to find out what the students already know about the flux so as to focus the succeeding discussion appropriately.

Activity Prompt: Give a group of rulers (of different sizes) to a small group of students and ask them to form a vector field.

- Hold the hoop with some of the rulers pointing through it and lead a whole class discussion about how you would measure the flux through the hoop.
- Specify that the students hands are the points at which the field is being evaluated, and the length of the ruler is the magnitude of the field at that point.
- See [[activities:reflections:adopters:vffluxconcept|reflections]] and [[whitepapers:narratives:fluxshort|narrati for examples from specific classes.

1.2 Student Conversations

- **Evaluating the field:** Because of students' soundbite understanding of the flux that it involves the field "pointing through" the surface, students may not realize that only the points (i.e. hands) lying on the surface (i.e. in the plane of the loop) contribute to the flux. Emphasize this by holding the hula hoop with only the rulers pointing through it, but with the hands not on the "surface" of the hoop.
- **Only perpendicular component:** Have one of the rulers lie in the plane of the hoop or at an angle to the plane of the hoop and ask the students what the flux is.
- **Conceptualization of $d\vec{A}$:** The size of $d\vec{A}$ in a field, $d\vec{A}$ is small enough that the field appears constant over the surface of each "little chunk of $d\vec{A}$."
- **Sign of the flux:** Discuss the need to specify a "direction" for the area. Emphasize that the dot product only picks up the component of the vector field perpendicular to the surface. Since the differential area element is a vector quantity, the flux can be positive or negative.
- **Static vs. Moving Flux:** Since this is a course in electroSTATICS, it is important to avoid examples with time dependence and language like the amount of stuff that "gets through" or "flows through" the surface. "Points through" is more helpful language.