Spatial Thinking in Undergraduate Research

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Over the past several years, institutions of higher education have put increasing focus on experiential learning and extracurricular research experiences in the undergraduate curriculum. This shift has allowed students the opportunity to move beyond traditional text-based learning activities to modes of learning that employ embodied, exploratory methods of inquiry. Spatial thinking is one of the key components involved in active inquiry, and research in almost any field involves some aspect of spatial thinking. For instance, many of the activities involved in lab-based research, such as manipulating objects in space and understanding physical cause-and-effect relationships require spatial thinking. Similarly, in simulation-based research students often work at a spatial scale that is different from the scale of the actual objects or phenomena. Spatial phenomena may also be represented more abstractly, as numbers or variables with no real-world spatial correlate. Other types of research methods in the humanities and social sciences also make use of spatial thinking, often by using space as a metaphor in order to help give structure to abstract concepts or phenomena.

When considering spatial thinking across the entire undergraduate curriculum, several important issues must be addressed. While it is clear that undergraduate research experiences encourage the authentic use of spatial skills and processes, many traditional classroom activities, like listening to a lecture, taking notes, or reading a textbook are less likely to engage students in spatial thinking activities. As we work to bridge traditional classroom activities and authentic research experiences, we should consider how we prepare students to engage in hands-on research, especially with regard to how they are asked to negotiate the spatial processing their research requires. Rather than taking a particular stance on how this should be accomplished, I pose the following questions in an effort to stimulate discussion:

- How similar are the spatial processes involved in traditional text-based learning and authentic research experiences within a single discipline? For instance, could the embodied and physical components of an authentic research experience help a student struggling to understand traditional text-based materials?

- Can (and should) the spatial thinking requirements of a discipline be explicitly conveyed to students in order to prepare them for an authentic research experience?

- What effect do research tools (e.g., software, equipment, and instruments) have on spatial thinking processes involved in conducting undergraduate research?