THE ROLE OF VISUAL REPRESENTATIONS IN SCIENTIFIC PRACTICES

Isomiddinova Shahlo
TUIT(501-21 group master)

ABSTRACT

The use of visual representations (i.e., photographs, diagrams, models) has been part of science, and their use makes it possible for scientists to interact with and represent complex phenomena, not observable in other ways. Despite a wealth of research in science education on visual representations, the emphasis of such research has mainly been on the conceptual understanding when using visual representations and less on visual representations as epistemic objects. In this paper, we argue that by positioning visual representations as epistemic objects of scientific practices, science education can bring a renewed focus on how visualization contributes to knowledge formation in science from the learners' perspective.

RESULTS

This is a theoretical paper, and in order to argue about the role of visualization, we first present a case study, that of the discovery of the structure of DNA that highlights the epistemic components of visual information in science. The second case study focuses on Faraday's use of the lines of magnetic force. Faraday is known of his exploratory, creative, and yet systemic way of experimenting, and the visual reasoning leading to theoretical development was an inherent part of the experimentation. Third, we trace a contemporary account from science focusing on the experimental practices and how reproducibility of experimental procedures can be reinforced through video data.

VISUALIZATION AS AN EPISTEMIC OBJECT

Schematic, pictorial symbols in the design of scientific instruments and analysis of the perceptual and functional information that is being stored in those images have been areas of investigation in philosophy of scientific experimentation (Gooding et al. 1993). The nature of visual perception, the relationship between thought and vision, and the role of reproducibility as a norm for experimental research form a central aspect of this domain of research in philosophy of science. For instance, Rothbart (1997) has argued that visualizations are commonplace in the theoretical sciences even if every scientific theory may not be defined by visualized models. Visual representations (i.e., photographs, diagrams, tables, charts, models) have been used in science over the years to enable scientists to interact with complex phenomena (Richards 2003) and might convey important evidence not observable in other ways (Barber et al. 2006). Some authors (e.g., Ruivenkamp and Rip 2010) have argued that visualization is as a core activity of some scientific communities of practice (e.g., nanotechnology) while others (e.g., Lynch and Edgerton 1988) have differentiated the role of particular visualization techniques (e.g., of digital image processing in astronomy).

CONCLUSIONS

Our conclusions suggest that in teaching science, the emphasis in visualization should shift from cognitive understanding—using the products of science to understand the content—to engaging in the processes of visualization. Furthermore, we suggest that is it essential to design curriculum materials and learning environments that create a social and epistemic context and invite students to engage in the practice of visualization as evidence, reasoning, experimental procedure, or a means of communication and reflect on these practices.

REFERENCES:

1. Achieve. (2013). *The next generation science standards* (pp. 1–3). Retrieved from http://www.nextgenscience.org/.
2. Barber, J, Pearson, D, & Cervetti, G. (2006). *Seeds of science/roots of reading*. California: The Regents of the University of California.