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Probing the nature of student explanations of visual phenomena: a pilot study

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Explanations of what we perceive visually may not depend solely on invoking an appropriate model for light but can also involve aspect of visual cognition. With regard to light, three incompatible models are used to describe its complex behaviour: straight lines, waves and particles. Each of these models describes aspects of light under different contextual conditions. For example, geometrical optics can be used to describe reflection, but this model cannot account for the bending of light when it passes through a slit i.e. the model of light travelling in straight lines does not offer the affordances for describing diffraction. However, optical phenomena are not always adequately explained by such a “bottom-up” (reductionist) approach. For example, the explanation as to why the moon is perceived to be larger on the horizon but smaller when directly above our heads requires a “top-down” explanatory component which draws on various cognitive aspects of visual perception.

The present, broad programme of work aims to map out the nature of student explanations of visual phenomena in terms of (1) choosing the appropriate model of light and (2) recognizing the extent to which a top-down component is necessary. To this end, an instrument Models and Perceptions in Optics Questionnaire (MPOQ), is being constructed and piloted as part of the first phase of the broader programme.

The present talk reports on some of the preliminary work that has been carried out in terms of question construction and piloting the questions to students both in South Africa and Nigeria. Specifically, we report on three questions: the first question involves the directionality of light travel with respect to the eye, the second question centres around refraction while the third question involves the observed size of the moon. Each question is framed as a debate among a group of posited students, each of whom offers a different explanation. Respondents must choose the explanatory option “with which they most closely agree” (Forced Choice Responses), and more importantly, are then asked to explain the reasons for the choice (Free Writing Responses). The FCR’s are analysed by simple tallying while the FWR data are analysed using a grounded approach.

The first version of the three-question instrument was piloted in South Africa with a group of 140 first year medical students, while a second version of the MPOQ was administered to a (mixed) group of 180 first year medical, physics and physics education students in Nigeria. The questions will be discussed in more detail and preliminary results and observations from the analysis will be presented.

Apply to be considered for a student award (Yes / No)?

Yes

Level for award (Hons, MSc, PhD, N/A)?

PhD

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