LETTER TO THE EDITOR

Phys. Educ. **51** (2016) 066504 (2pp) iopscience.org/ped

Reply to 'Misconceptions indeed'

N Fotou[1] **and I Abrahams**[2]

[1] Department of Education, National University of Ireland, Maynooth, Ireland
[2] Science and Technology Education Group, School of Education, University of Lincoln, Lincoln, UK

E-mail: Nikolaos.Fotou@nuim.ie

Abstract

In a recent letter to the editor (2016 *Phys. Educ.* **51** 066503), Schumayer and Scott raised concerns about one of the novel situations presented in our article titled 'Students' analogical reasoning in novel situations: theory-like misconceptions or p-prims?' (2016 *Phys. Educ.* **51** 044003). We greatly appreciate their interest in our study and in this reply we address the concerns raised.

Firstly, we are please to read that both authors (Schumayer and Scott 2016) agree with us about the importance of research into how students think about novel situations. The second point that we would make is that the main purpose of our article was to consider *how* students reason in novel situation with our main finding being that students' ideas are best understood not as being theoretically grounded but rather as spontaneous constructions based on analogies which, in turn are derived from their prior knowledge and experiences.

The authors of the letter take issue with our claim that the students had 'erroneously predicted' the outcome claiming this to be misleading. We would suggest that such a prediction was indeed erroneous, in the sense that it is in conflict with the scientifically correct prediction. Despite being erroneous we articulated *why* such erroneous predictions were made and how everyday experience, from which students draw analogies, can lead to such erroneous predictions. To claim that such a predication was not erroneous would be scientifically incorrect.

With regards to the second situation we are surprised that the authors disagreed with answer B. Whilst the motion is indeed harmonic the amplitude of the oscillations will, unless the transfer of gravitational potential energy into kinetic energy and vice versa is 100% efficient, decrease over time with the object eventually coming to rest at the centre of the Earth. For a more detailed analysis of this situation in terms of the scientific answer please see Fotou (2014) in appendix C.

We of course recognise that this is a significant simplification in the sense of how a tunnel could be constructed and the extremes of temperature etc. The issue was not to focus on the simplification but on how the students, presented with a novel situation, perceived the problem and the analogies that they drew on to make their predictions. After getting the answer we then probed *why* they gave the answers they did and in many cases their answers were best understood as arising from spontaneous reasoning by analogy to everyday experiences.

We would emphasise that these situations were designed and presented in a manner that was accessible to students aged from 10 to 17 and, as such, a high degree of simplification is necessary. Despite all of the simplifications what emerges is that many students drew on the same or similar analogies because they saw a

similarity between the novel situation and other everyday experiences with which they were very familiar.

Received 24 August 2016
Accepted for publication 8 September 2016
doi:10.1088/0031-9120/51/6/066504

References

Fotou N 2014 Students' predictions in novel situations and the role of self-generated analogies in their reasoning *Doctoral Thesis* University of Leeds, UK

Schumayer N and Scott T F 2016 Misconceptions indeed *Phys. Educ.* **51** 066503

N Fotou is a physics teacher and has a MA and PhD in science education. He is a lecturer at University of Maynooth, Ireland. In addition to doing research in the area of students' ideas and reasoning, he is also interested in interventions aiming at improving students' achievement in, and attitudes towards, science and mathematics.

I Abrahams is Head of School of Education and Professor of Science Education at the University of Lincoln, UK. He has published widely about all aspects of practical work and has led various large-scale evaluations of educational interventions and is particularly keen to foster a more evidence-based, as opposed to opinion-based, approach to educational initiatives.