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Teaching embryology through science fiction and role play

Clemens Kiecker*, Jonathan Clarke, Esther Bell

*) Corresponding author: 4th Floor, Hodgkin Building, Guy's Hospital Campus, King's College London, London SE1 1UL, UK; email: Clemens.kiecker@kcl.ac.uk

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As the students described in this manuscript remain anonymous, no ethical approval was required for the delivery of the workshops or the preparation of the manuscript.

What problem was addressed?

In our teaching of 2nd and 3rd year Biomedical Sciences and intercalating Medical students at King's College London we frequently observed that students performed well in memorisation and recall tasks, but less well in tasks targeting the understanding of theoretical concepts. One such *threshold concept* (a concept embedded in the thinking within a research community that students often struggle to grasp, but the understanding of which can have a transformative effect on their learning in a specific discipline)[1] is the idea in embryology that signalling factors called morphogens form gradients across tissues and dose-dependently assign multiple different fates to the cells exposed to them.

What was tried?

In order to engage students with the morphogen concept in a constructive way we devised a Problem-Solving Workshop based around science fiction and role play in a 2nd year embryology module. Although the relatively large class size (around 180 students) makes the implementation of active learning scenarios on this module difficult, we reasoned that engaging the students with the morphogen concept on smaller 3rd year modules would be too late to lay a solid foundation for the efficient learning of embryology in the 2nd and 3rd years of our programmes.

To this end, we halve the class and run two workshops of 60 min each. In order to create a 'sense of occasion' we hold them in a teaching laboratory fitted with tables that accommodate eight students each. Students at each table are told that they form a research team that has received a grant to investigate a newly discovered organism: a marine, tube-shaped animal that has three rows of morphologically different tentacles at regular intervals along its head-to-foot axis. We hypothesise that a morphogen gradient along this axis could pattern the tentacle rows. For the next 15 min the groups are tasked with developing a set of three to five defining criteria for what constitutes a morphogen. This activity is supported by ten tutors that rotate between groups, and is followed by a 5 min interview period in which the session lead asks representatives of each group to present their criteria in front of the class. Subsequently the groups are asked to spend 20 min to devise a set of experiments that test the proposed criteria (also tutor-assisted). This part of the session is followed by another 10 min interview period in which groups have the opportunity to 'pitch' their proposals.

What lessons were learnt?

We found that this team-based brainstorming activity encouraged students to engage with the morphogen concept in an unprecedentedly deep manner. Despite the large class size, only very few students seem to take a back seat in their groups, and the student feedback on those classes has been positive throughout. We conclude that making students members of a hypothetical community of practice (their 'research group') encourages a constructivist and heuristic learning approach.

We also suspect that the fictional element adds a playfulness that uncouples students from the fear of 'getting it wrong'.

Reference

1. Meyer JHF, Land R. Threshold concepts and troublesome knowledge (2): Epistemological considerations and a conceptual framework for teaching and learning. *Higher Education* 2005;**49** (3):373-388.