

# Increased structure and active learning: Can we bridge the achievement gap in South African science?

**Author:**

 John Measey<sup>1</sup>
**Affiliation:**
<sup>1</sup>Department of Biodiversity and Conservation Biology, University of the Western Cape, Cape Town, South Africa

**Email:**

john@measey.com

**Postal address:**

Department of Biodiversity and Conservation Biology, University of the Western Cape, Private Bag X17, Bellville 7535, South Africa

**How to cite this article:**

 Measey J. Increased structure and active learning: Can we bridge the achievement gap in South African science? *S Afr J Sci.* 2011;107(9/10), Art. #873, 1 page. <http://dx.doi.org/10.4102/sajs.v107i9/10.873>

Haak and colleagues<sup>1</sup> detail a huge paradigm shift in the way that science can be taught in order to bridge the achievement gap in the teaching of science to USA undergraduates by discarding the traditional professorial lecturing approach that so many of us grew up with, and replacing it with active learning. Their result: an overall increase in the achievement of all students, and especially those from disadvantaged backgrounds. Not only did they achieve what many of us have struggled to implement over the years, but they did it in a way that is more cost-effective than the traditional supplementary instruction and mentoring models.

While the size of the skew and the depth of the achievement gap may give us pause for thought, too often we think that the problems faced by teaching science to South African undergraduates are unique and that we require different solutions from those derived in developed countries. Recorded failure rates in introductory courses in US sciences range from 25% to 85%.<sup>2</sup> Since the 1970s, the USA has had active policies to increase the number of under-represented minority students completing tertiary education. The standard responses have been to retain these students in the traditional teaching mainstream, but to supplement their learning with high-cost instruction and mentoring. Although this has had some positive effects, there has been a low return per dollar invested.

So how did Haak et al. do it? Scott Freeman persuaded his colleagues at the Department of Biology, University of Washington, to completely rewrite their introductory courses. Over a period of 7 years, they phased out their traditional stand-up routines and replaced them with active learning based on the following:

- Socratic lecturing – lecturers pose frequent questions to the class and supplement the raised hands of frequent responders with random calls to students whose names are obtained from a class list.
- Ungraded active-learning exercises – lecturers give quick written tests followed by discussion and demonstration with student participation in informal groups.
- Clicker questions – students select buttons on an electronic response device according to their responses to questions posed in a class for graded responses. Software displays the results instantly on-screen and correct and incorrect responses are discussed.
- Practice exams – lecturers conduct timed exam-style questions for graded responses via the departmental intranet.
- Class notes summaries – students state the three most important concepts in that week's teaching, so that they actively use their course material for graded responses.
- Reading quizzes – students are given graded multiple-choice questions the night before class via the intranet.
- In-class group exercises – groups of three or four students answer exam-style questions on current class topics. Teaching assistants and course teachers move through the class to monitor conversations and provide guidance.

So would it take a lot of effort to change foundation year courses to this active learning style? Freeman himself says that running the class is a lot more fun:

It's just a different way to setting up the course where you do all your work up front... I like to say that my job isn't to tell my students things, my job is to ask my students good questions.<sup>2</sup>

Active learning really means a new and active teaching style, and there is no reason to limit these styles to those outlined above. The pay-off is not just to boost learning for everyone with this intensive format, it is that disadvantaged students do disproportionately better.

## References

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