

Special issue: Innovative Teaching Personal Essays

## Research-Based Teaching: Teaching using Research or Learning to do Research?

Henk Keers

*University of Bergen*

Research-based teaching, or so I thought, after I took my first course in university education, means that you teach using findings from educational research. In other words, people do research on teaching, publish that in a peer-reviewed paper and then you use that research in your teaching. Obviously this is an important and useful concept providing numerous proven tools, ideas, analyses etc. related to teaching. However, I found out later that there is another different definition of research-based teaching. This second definition states that research-based teaching is teaching where students learn to do research. In this brief essay I share how I have used both these concepts in the never-ending quest to improve my teaching.

I started in my current university job nine years ago, after having done a postdoc and nine years of work in the industry. My main teaching job, so I was told when I started, was to set up two classes on computer programming for geophysics students, an introductory class and a more advanced one. So that is what I did. My strategy in doing so was to look for the teaching material online and to develop teaching methods.

In the end, that is not how it worked out. I had to develop the teaching material but could find information about the teaching methods online. This was a bit of a surprise to me. In particular, a textbook in this field did not exist. The teaching material that, by necessity, I came up with was basically a sequence of programming exercises starting from scratch and ending at a level appropriate for beginning master students.

As for the teaching methods, I realized that traditional lectures would not be appropriate for teaching programming, not least because I had had a bad experience myself in this regard.

It was clear to me that to *learn* programming you actually have to *do* programming. So I decided to keep the talking to a minimum, basically explaining the material needed for the next couple of exercises and setting the students to work. I myself walked through the classroom answering any questions the students might have. This seemed to be a reasonable setup, but it became clear that there was a lot of room for improvement, not in the least because of the typical beginner mistakes, such as wanting to do too much at too high a level. Giving and receiving feedback was much more important than I realized. Also, the level had to be right. It turned out there were many ways to fine-tune this: asking the students what background they had at the beginning of the course, informal conversations with students during the course, asking students whether they were familiar with a concept during the teaching itself and feedback from teaching assistants. In addition to these things there were the big unanswered questions: how do I know whether I am doing a good job? Is there a (systematic) way to improve my teaching?

Luckily, about this time, two years after I had started teaching, someone told me about a university education course. I was vaguely aware of this, but having been busy with this and that (mainly teaching and research), had not looked into the content of these courses. It turned out that there was an introductory course on university education and that there were various other courses that built on this course. It was at this course that I learned about the first definition of research-based teaching.

In particular I learned about active learning methods, course alignment, examination methods etc. I also learned that there was an enormous amount of literature on these topics and especially active learning. The books, journals, papers and webpages were too numerous to count. The university education class was practical, so I was encouraged to experiment with active learning methods in my classes and write a short paper about this, which was eventually published. It was very helpful to take this research-based education as it helped me to structure, vary and improve the courses. In fact, at one point I might have overdone the active learning part. I realized this when I saw the slightly desperate look in the face of one of the students when I announced yet another active learning method we were going to do. Clearly, when you want to improve your teaching it is important to find a balance and not to try too much at once.

Once the teaching is more or less in place, this improvement is, in my opinion, the hardest part of teaching: to keep finding possible sensible improvements, to implement these in a way that is meaningful, and to gauge afterwards whether or not they actually have been worthwhile. Besides being difficult, this is also time consuming, takes energy, and can sometimes be a bit stressful. In fact, this whole process of improving teaching reminds me very much of doing research: the demands put on a person doing research, cognitive and otherwise, seem to be very similar to those involved in improving teaching.

Other improvements in my teaching came by thinking and reading about teaching, talking to people, making a list of the many parameters related to my teaching. These parameters included the students' background (Bachelor/Master/PhD, internal/exchange, major/non-major etc.), informal and formal (through a survey) feedback, and the realization that writing a paper was difficult for many students. This last problem was partially solved by asking the students to write a brief paper based on a literature review. This then led in a natural way to the latest change in the class, the one involving the second definition of research based education.

I do not remember how exactly I found out about this second definition of research-based teaching. But once I did, a few years after I took the university education class, I implemented it in the second class I was teaching. I gave the students the option to do original research and write a paper on that (instead of writing the literature review paper). This year's spring semester about half of the students in this class (five out of ten) did a research project. Given the interesting papers that the students came up with, and the formal survey held after the class, it seems that this latest innovation, based on the second definition of research-based education, was a small success.

An interesting aspect of this research-based education experience was which students actually chose to do the research project. Students from all levels (Bachelor, Master and PhD) were taking the course, but the research project was only chosen by half of the Master students and the PhD student. Perhaps this is not unexpected; students for whom the research is more directly relevant are more likely to do a research project. It is possible that other factors also played a role (motivation, personal interest etc.) but they seem less pertinent. As the students were very positive about the research project, and since their papers were at a quite high level, this certainly seems worth repeating.

Clearly, these two concepts have been important in my attempts to improve my teaching. The first one is very broad, the second one very specific. The second could perhaps be seen as an application of the first one. The main point to me is that they are part of a spectrum of tools that exist to improve teaching. And clearly that is what university teaching should be about. Not only are the topics being taught non-trivial, there are many other variables that determine how a course should be run. In fact, overall it is so complicated that it seems to me that improving teaching is a process that is fundamentally part of the teaching itself, and, just as is the case with teaching, there is no end to it.