53 Powerful Ideas All Teachers Should Know About

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Ideas and concepts being taught may not replace students' existing ideas

Teachers sometimes behave as if students' brains were tabula rasa – blank sheets. They are not. Many of the things teachers try to teach students about, the students already have some ideas about. They may be half-formed, ill-informed, and sometimes hopelessly wrong ideas – but nevertheless they have these ideas in their minds and have relied on them thus far. They are unlikely to give them up without a fight and often they succeed in retaining these crude ideas despite teachers' best intentions. Sometimes they retain these ideas as well as the new ideas they are taught – but the new ideas may be taught 'in theory' as abstract concepts, while their existing ideas were developed to help them to make sense of everyday reality. So if you ask students about everyday reality, their old ideas pop out instead of the new ideas they have been taught.

Here are three examples.

The Physics Department at the University of Surrey, nearly 40 years ago, got very frustrated at having to re-teach the Physics school syllabus in the first year at university because the concepts students needed to have grasped, if they were to progress, were understood so poorly, despite their students having all achieved top grades in Physics from their school exams. They devised a study to try and work out what was going wrong. Some of the questions they asked incoming students involved pictures on postcards of physics phenomena. One had a picture of a strong man lifting some gym weights above his head. Students were asked "This is a question about the Physics concept of work. Is this man doing work?" Now in their school exams these students had correctly trotted out a definition of 'work', and used a formula to correctly calculate how much work was done in an example. In Physics 'work' is done when a force is moved through a distance, so if the man was standing still then he was not doing work (except perhaps chemical work in his muscles – a more sophisticated notion). But in the interviews students said things like "It depends if he is being paid for it" and "It depends how strong he is" and "How long has he been standing there?" Their naive understanding of the notion of 'work' had survived their Physics schooling intact and was still being used to explain everyday phenomena. I studied, and passed, A-level Physics at school myself and I discovered from these postcard pictures that I did not understand about half of the concepts this Surrey University study enquired about. It turns out that my experience was about average.

There is an infamous video that was made in the ivy covered quad at Harvard University after the graduation ceremony of some

Science students. These were some of the brightest young people in the world at the top university in the world. In informal interviews they were asked "Why is it warmer in summer?" Their answers were wrong: laugh out loud wrong. These were the kind of explanations a poorly educated 16 year old might offer – though with Harvard-bred self-confidence that they were right. The last interview question was about what courses they had recently taken. They proudly answered things like "Astrophysics 490". Clearly their very advanced science education had made little impact on their understanding of even very simple everyday science phenomena. The video is called 'A Private Universe' and can be found at http://www.learner.org/resources/series28.html It is a hoot.

When Ferenc Marton's group of phenomenographic researchers started off at Göteborg some of their work focussed on students' ideas about learning and spawned all the work on deep and surface approaches to learning. But much of their work was not about process, it was about content. They examined what students understood about the concepts they were being taught on their courses, and how these conceptions changed as a consequence of being taught. In one study, of an Introduction to Macroeconomic course of a type taught all over the world using standard textbooks, students were asked, before they started the course, questions such as "Why does a bun cost 1 krone?' which was about the economics concept of 'price'. They found a limited number of distinct conceptions, including attributing price to characteristics of the bun, to all the costs associated with producing the bun, to demand for the bun and, occasionally, recognising that both supply and demand factors had something to do with determining price. In economics, 'price' is actually a relational concept linking both supply and demand factors. At the end of the course the researchers repeated these questions, in interviews, to the same students. Across a range of economics concepts what they found was that students' conceptions were largely unchanged but they now used technical economics language to justify and explain their previous (wrong and naive) conceptions. Some students dropped to a cruder conception, as a consequence of being taught for a year, but now explained it in a very sophisticated (but hopelessly wrong) way. Almost all the students passed their course, regardless, many with high marks, because the exam questions failed to unearth their actual level of understanding.

These three examples are all in 'technical' subjects with very tight formal definitions of concepts. In the social sciences the problem is much worse because there is so much scope for ambiguity, because it often deals with subject matter everybody already has an opinion about, and because it is much harder to assert what is 'right'. It also uses everyday language in specialist ways to mean new and distinctive things. This leaves an enormous amount of scope for misconceptions to survive, or even be reinforced.

There are some fairly obvious conclusions to be drawn from these kinds of study. First it is important, at the start of your teaching, to elicit students' existing understandings of the phenomena you are teaching about and get them out in the open ... and show how these understandings are inadequate in various ways to explain various everyday phenomena they can easily make sense of. It is asking for trouble to leave these existing ideas intact and unexamined, or to say things like "forget everything you ever knew about this and start from over here" – because they will not, and cannot, forget.

Second, it is important that students are actively involved in constructing their own new understandings – through conversation, through articulating their own understanding, through tackling problems involving the concepts in everyday settings, and seeing that others tackle these problems differently and so on – rather than only passively listening or passively reading. Such constructive processes are likely to engage existing understandings and unearth their limitations.

Third, tests and exam questions need to focus on understanding: it should not be possible to get a good mark just by memorising definitions and algorithms if you do not understand the underlying concepts. Again, asking for personal explanations of everyday phenomena is a good way to do this.

For educational developers the same issues arise in trying to teach teachers about teaching – teachers may have very well developed ideas, some of them obviously wrong, which a formal training course can leave largely intact.

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