

Ownership and transformation: teachers using curriculum innovations

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Abstract

Who owns a new science course once it has been developed? And if teachers teach a course in their own way does this transformation ‘improve’ or ‘deform’ it? The development of *Advancing Physics* provokes some fresh thought about these questions.

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Introduction

I have just completed, with a large and talented team of teachers, a major piece of curriculum development for the Institute of Physics. We have produced an entirely new physics course for what in the UK is called ‘A-level’; that is, pre-university physics for age 16–19. We have produced two textbooks of a novel form, one for each year, and a very large collection of resources for teachers and students, stored on two CD-ROMs. The whole is called *Advancing Physics*, published by Institute of Physics Publishing.

This experience, which is the second such in my career since I was also involved 30 years ago with the development of Nuffield Advanced Physics, has revived in my mind a number of questions about curriculum development. It has led me to a number of new, and probably controversial, answers to those questions. It is these questions and my current view of the answers to them which I propose to discuss here.

The questions

The world has, over the last 50 years, seen a large number of newly developed courses in the

sciences. In physics, one of the earliest was PSSC from the USA, followed by the Nuffield projects in the UK. Since then there have been hundreds of such developments around the world. Many of them are attached in all our minds to their distinguished originators and guiding spirits: in the case of PSSC to Jerrold Zacharias and Francis Friedman, followed by Uri Haber-Schaim. In the case of Nuffield Physics, we all remember the name of Eric Rogers. My question is, to whom do these projects truly belong? Is it to their famous leaders and originators, or is it to someone else—in particular, is it that they really belong to the many ordinary teachers in ordinary schools who use and teach them? In my own case, is *Advancing Physics* ‘my’ project, or is it the property of the several hundred teachers now teaching and examining it?

- That is the first question: the question of ownership.

My second question is one about whether a project’s ideas and materials are taught in the way that was intended. Are teachers ‘faithful’ to those original intentions, or do they change them in large or small ways? Would the authors of the project recognize a lesson as belonging to it, if they sat in

on a classroom? Do teachers 'deform' the original ideas? Or do they perhaps improve on them?

- That is my second question: the question of transformation.

Over the years these questions have been discussed and debated, especially the second, though they are clearly related. There have been arguments about whether it is possible to have 'teacher-proof' curriculum materials, which teachers cannot subvert or destroy. Few think it is possible, though some have tried. There has been empirical evidence of the importance of training for teachers taking up a new development, and plenty of evidence of teachers changing the ideas when they teach them.

As it happens, at the same time as working on *Advancing Physics*, I participated in a pan-European research project 'Science Teacher Training in an Information Society' (STTIS), led by Roser Pinto. A main thrust of this project was to observe the process of innovation in classrooms, and to note the kinds of transformation that can take place. So this too contributed to my thinking about these two questions.

The experience of *Advancing Physics*

One of the most striking features of the work on *Advancing Physics* was the importance to teachers of feeling that they belonged to the project and it to them. We started with working groups involving in all about 300 teachers, and the final materials were written by some 50 or so of them. Many have said how important it felt to be making a contribution, however small.

Even more important, as trials and pilots developed and moved into full scale implementation, we built up an e-mail network on which those teaching the course could raise queries, make objections, ask and answer questions, and share with others additional resources they had produced for their own students. This network has proved an outstanding success. We, as the project developers, had to take some hard knocks as teachers objected, sometimes fiercely, to what we had proposed. But we learned to keep quiet for a while, because often another teacher would answer on our behalf, usually more convincingly than we could.

From the beginning, it was essential to the design of *Advancing Physics* that it would provide

a large and flexible set of resources, derived from the best ideas of many talented teachers. For that very reason, however, the project is initially daunting to teachers who are new to it. How are they to choose amongst so many resources? Which will prove 'best' for their particular students? The Teacher Guides on the CD-ROMs give advice, but it is never enough. What has proved very successful is for Pilot teachers to publish by e-mail their own choices of resources, their own 'paths through' the material. These have much greater credibility than any scheme of work the project team could have devised. And, more important still, they are very evidently a starting point and not a final solution. Teachers are very happy modifying and adapting them to circumstances. And they know the kinds of school from which the plans have come, so they can make allowances for likely differences between students.

This flexibility, though daunting at first, has proved to be a major factor in the success of *Advancing Physics*. Teachers are acutely aware of the need to tune their teaching to the varying needs, abilities and interests of classes. Some face classes of students who lack confidence and need to have that confidence built up carefully and slowly. These students need tasks at which they can succeed. Others, not so many, have classes of confident and talented students, who need and enjoy a difficult challenge. Girls and boys do not always agree about the styles of learning they prefer, nor about what topics are interesting. So we provided resources using different styles, from collaborative discussion to experiment and problem solving. And we varied the level of difficulty of resources rather widely.

As a consequence, teachers see that *Advancing Physics* can be adapted to their individual circumstances. This is the only possible way to appeal to a large audience. So far the strategy has worked even better than we hoped, with about 9000 students (out of a national total of about 40 000) starting the new course in its first full year.

The question of ownership

One of the strongest conclusions to come out of decades of studies of the success and failure of a wide variety of curriculum innovations is that innovations succeed when teachers feel a sense of ownership of the innovation: that it belongs to them and is not simply imposed on them. This

lesson is hardest to learn for countries with a strongly centralized curriculum. The seemingly simple question, 'If this is the best, why should everybody not do it?' has to be given a subtle answer, namely that 'the best' is an elusive thing, not always the same for everybody. And further, a teacher willingly and enthusiastically teaching an 'inferior' course, will often do a better job than if obliged to teach a 'better' one.

Over the years the Nuffield Foundation has built up much experience of developing and supporting curriculum innovations. Its view, born of this experience, is that project development teams have to learn to 'let go'. The team have to give of their best, to express as forcefully as possible their own views of how their material ought to be used, and then let teachers take over. Those of us who have been in this position are very often told, 'Yes, I teach your course, but not in the way you suggest'. For example, we proposed delaying mechanics for a while, so as to start with more interesting and less mathematical things. But some teachers re-instate it to its traditional beginning role. I don't agree with them, but I must respect their decision. Others 'do it our way', and the two groups debate on e-mail about who is right. That has to be healthy.

Does vision matter?

If, in the end, project teams have to 'let go' and let teachers take on ownership of 'their' course, why have a project team in the first place? Why not just collect materials from many teachers and make them available more widely? To put the question another way, is there a place for a 'guiding vision' for a curriculum development project? Is there a place for strong views about new directions to take?

Some people do believe that the answer to this question is 'no'. They hold that effective development has to come from the teachers—'bottom up', or from 'periphery to centre' as it is sometimes expressed. I do not agree with this view. I do think that there is usually a vital place for strong project leadership, and for a coherent conception of the overall aims and strategy. Indeed historically, project leaders around the world have exerted an international influence out of proportion to their numbers. Some—I think of Eric Rogers—have been truly *prima donnas*. But as Jerrold Zacharias once said, 'It's OK to be a *prima*

donna—if you can sing'. And Eric Rogers, like Zacharias himself, could certainly sing.

Is this a paradox: that teachers have to take over a project and make it their own, and that it needs a strong, even individual, vision? I think not. Indeed, I think that for the project to command respect and allegiance, such a vision is necessary. There has to be something of real and novel value for teachers to identify with. They need to feel a sense of belonging to something larger and stronger than simply a collection of resources. And they need some vision to guide their choices. Of course, that vision will not remain unchanged in the process. Teachers will transform it as they use it, but it does provide something for the mind and imagination to get a grip on.

The question of transformation

So much for the first question: the question of ownership. I turn now to the second, related question, of transformation. Here I shall be a little more theoretical, in contrast to the largely pragmatic discussion of the first question.

'Putting across the ideas of a project' is essentially a matter of communication. The 'obvious' or 'commonsense' view of communication is that the ideal is for ideas to be transmitted faithfully, without distortion. This view of communication underpins much of late twentieth and early twenty-first century life. 'Accountability', the mainstay of many political systems, requires people to be told clearly and unequivocally what is required of them, so that those managing affairs can see clearly how well (or badly) everyone is doing. It all sounds efficient, even (or maybe not) innocent. If you can't say clearly what you want, how can people deliver it and how can you know if they have? So you must spell out exactly what you want, and *a fortiori*, since it is so necessary to do so obviously it must be possible. But what if it isn't possible?

I have to say that I think that it is impossible. I have to say that all this is founded on a terrible mistake about the nature of communication. The view I take of communication is that it is, always and everywhere, transformative. The 'receiver' or, better, the 'listening partner', has no option but to make their own sense of the message. Either they aren't listening, or if they are, they transmute the message to make their own sense of it.

You are doing it at this very moment. As you listen or as you read these words, you are asking ‘What sense does this make?’. You may be thinking, ‘Surely not. There must be at least some cases of pure simple unmodified communication’. You are certainly thinking, if indeed you are paying attention at all, about how this opinion of mine fits in with what you yourself think or assume. Whatever happens, you simply cannot ‘take it in’ without making your own sense of it.

This view of communication derives from the socio-linguistic theory of Michael Halliday, as developed by Gunther Kress and Theo van Leeuwen, together with the views of other linguists such as George Lakoff and Mark Johnson (see References). You can find something of its application to science education in the small book *Explaining Science in the Classroom* (Ogborn *et al* 1996). It is also, I believe, consistent with the views of Piaget.

For there to be communication at all, there has to be a *difference* between two parties, a gap to be bridged. Communication ‘closes the gap’ partially, but not simply by the listening party ‘adopting the position’ of the speaking party. ‘Understanding’, on the part of the listening party, is simply the achieving of some kind of reasonable ‘fit’ between what the listening party already knows or thinks and what the listening party takes to have been said. As the game called in the UK ‘Chinese whispers’ shows, what you think you hear is not what was actually said. And what you think you hear is decided by your own interests, by your own concerns. Their existence is the very reason *why* you are communicating at all, so they are not in any way a kind of accidental interference to the communication: they are its very motor. If you aren’t concerned you won’t listen, and if you are concerned you will understand something that matches your own concerns and ideas.

Transmutation in action

Now let’s apply these thoughts (that is, what you have made of them) to the turning of advice, exhortation and teaching materials into practical action in your own classroom.

What you choose to do will certainly transform ‘what was intended’. In small ways, you will add (or subtract) your own personal touches. You may, for example, add to an activity involving analysing data using a spreadsheet, your

own belief that using spreadsheets is a valuable personal skill usable in later life. Or, differently, you may stress the importance of exact calculation. Whatever you do, you will ‘colour’ the activity according to your own beliefs.

The European project STTIS recorded many examples of these and much larger transformations (Viennot *et al* 1999, Pinto *et al* 2001). Some Italian teachers took work with a computer-aided laboratory and changed it into an example of the working out of theory in physics. Why? Because they gave theory much higher priority than experiment in their own values. Some French teachers, faced with a carefully designed optics programme designed to stress that light really comes to the eye from all objects that we see, left out pieces that the designers thought to be crucial, in favour of activities with which the teachers were more familiar. In *Advancing Physics*, we have many similar examples. We stress the rotating phasor picture of waves (and of quantum behaviour); some teachers ignore it, or regard it as misconceived. One said, ‘It shows that you don’t really believe in waves’. The remark is acute, because in dealing with quantum behaviour, ‘not really believing in waves (or particles)’ is the whole point.

I won’t labour the point with further examples, of which there are many. Seen from one point of view, they are like ‘distortions’ of the ‘designer’s intentions’. Indeed, speaking as a designer, that’s exactly how they often seem to me. ‘How *can* teachers spoil it so?’ I ask myself. But, seen from the teacher’s end, they are examples of adjusting someone else’s ideas to your own. They achieve a better fit with what you believe in.

Of course there exist some lazy or stupid teachers. But it is unwise to rely on this explanation, given the inevitability (not merely the chance) of transmuting all messages in communication. Rather, it is better to adopt what the philosopher Davidson would call a principle of charity, and assume until further evidence that transformations happen for good reasons. The teacher who does things another way, unlike or even opposed to my way, generally has some kind of reason for doing so, even if it is not articulated.

My role, as curriculum developer, becomes like that of a person who says, ‘Be reasonable, see it *my* way’. It *is* reasonable for me to tell people, as clearly and forcefully as I can, what

would be my way. But it is equally reasonable for them not fully to agree. Indeed it is not even possible for them to fully agree: there is *certain* to be some transformation, however small, in the act of communication.

My answers to the questions

So here now are my answers to my two questions.

First, teachers, not the developers, are the true owners of a curriculum development. This is not a sentimental point, seeking to give importance to teachers. It is a point of practical necessity. To do a job well is to feel in charge.

But there is also the sense of *belonging*. Only to the extent that the curriculum development has a strong vision that teachers can identify with, will there be something, a community, to belong to. So the sense of community is crucial too, and is worth much trouble and money in supporting.

Second, there is in a way no such thing as material 'being taught in the way intended'. That 'way' cannot, in the nature of communication itself, be 'transmitted' without change. Certainly there is teaching of the material of which I, Jon Ogborn (or any other developer), approve or not. But our approval is not the point. It is best to assume, without evidence to the contrary, that changes have been made for what the teachers feel to be good reasons. If asked, we will express a view. But that view is just a part of an ongoing discussion about how to teach things, not a definitive end-point. It is not, after all, the developers who face your students in your classroom.

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