An investigation of the affordances of ICT for the development of effective pedagogy in mathematics and science classrooms – the i-ped project

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Background

The i-ped project aimed to develop research capacity in three institutions; Swansea Metropolitan University (SMU), University of Wales Institute Cardiff (UWIC) and Trinity College Carmarthen (TCC) by working collaboratively with a mixture of experienced and novice researchers with the aim of gaining external funding for research into the affordances of ICT for the development of effective dialogical pedagogies in mathematics and science classrooms.

The capacity building element of the project aimed to develop research skills and theoretical understanding amongst the group through collabora-tive research activity in preparation for the submission of a research proposal for external funding. This capacity building was not intended to occur in a purely theoretical context. The team had been gathered with the intention of investigating a complex area of pedagogy that was significant in the Welsh context but was currently under-researched.

The focus of our research activity

In recent years there has been significant investment in ICT in Welsh schools. In particular, projective technologies such as Interactive Whiteboards (IWBs) have become common in our schools. However, the form and efficacy of ICT-based pedagogies remain under-researched, particularly in relation to the distinctive policy environment of Wales (Kennewell et al., 2008).

Recent policy initiatives in England and Wales have been concerned with the development of whole class teaching approaches that are intended to be 'oral, interactive and lively' (DfEE, 2001: 1:26). This was intended to be more dialogical than the traditional recitation script of Initiation, Response, Feedback (IRF) (Sinclair and Coultard, 1975). There is growing consensus that effective pedagogy requires dialogic approaches to whole-class teaching, greater responsibility for learners during interactive group work and independent enquiry (Alexander, 2004).

However, interactive teaching has largely been implemented as pupil participation in fast, teacher-led question and answer sessions. Although teachers ask more questions, the traditional triadic recitation script persists (Moyles et al., 2003; Hargreaves et al., 2003; Smith et al., 2004).

The introduction of projective technologies such as IWBs was intended to support the development of more dialogic pedagogies. Unfortunately, recent large scale research (Smith et al., 2006) reports that in lessons involving IWBs, initially there is an increase in the pace of lessons but fewer uptake questions are used and pupils' responses remain short. The traditional IRF recitation script is more prevalent in IWB lessons (Smith et al., 2006). It is perhaps unsurprising then that large scale studies report that the introduction of IWBs does not lead to improvements in pupils' attainment in the short term at least (Smith et al., 2006; Moss et al., 2007).

The ESRC/TLRP project 'Interactive teaching and ICT' (ITICT) explored some of these issues, and its findings highlight the limited influence of ICT in improving attainment compared with the effect of dialogic pedagogy. It identified the need for research into how pedagogical practices may be developed which integrate ICT in support of dialogic teaching (Kennewell et al., 2008).

Our aim was to build on the results, insights and research expertise gained in the ITICT project to gain external funding to investigate how ICT can support the development of dialogical pedagogies in Mathematics and Science. We wished to explore which affordances of ICT were being inte-

grated into pedagogy and what factors influenced the interaction between ICT and pedagogy in the differing social, cultural and political contexts of Wales and England.

Research Methodology

We intended eventually to develop a large scale project that would use a multi-level approach involving LEAs, schools, teachers and pupils as partici-pants. A mixed methodology would be employed, based on a range of quantitative and qualitative data drawn from action research networks of collaborating teachers from Wales and England.

Dialogical pedagogies with ICT would be investigated using a range of qualitative approaches such as interviews and classroom observation. However, at the heart of our research design was the use of Video-Stimulated Reflective Dialogue (VSRD) with teachers and pupils – a strategy that had been used to good effect by some of the team in the earlier ITICT project.

Issues for the project – Catch 22

The group included members with a wide level of expertise in research terms. Some members of the group were experienced researchers with research and publication records that would be acceptable to funding coun-cils such as ESRC. Other members of the group were highly experienced in teacher education and training and were skilled, knowledgeable and experi-enced teachers, but were relative novices in research and publication terms.

The difficulty for beginning researchers working in teacher education, is that they are unlikely to be successful as named researchers on a bid to a funding council without a research track record, but it is difficult to gain a research track record whilst working as a teacher educator with a heavy teaching load and without external research funding – Catch 22.

Our Strategy

The strategy employed by the i-ped project was to work as a team, devel-oping skills and theoretical understanding amongst the group through

research training and collaborative activity whilst developing a small scale research proposal prior to submitting a larger scale proposal.

Our approach employed a mixture of mentoring and peer-coaching. Rather than developing research knowledge and skills through a theoretical course to be employed later, we intended to employ a form of legitimate peripheral participation (LPP) (Lave and Wenger, 1991) whilst working together on issues of real concern for our research focus.

The relationship envisaged was closer to peer to peer coaching than mentoring. The issues addressed in our team meetings were always suffi-ciently complex to ensure the knowledge and skills of all participants were being extended. The intention was that each member of the team would be required to bring specific knowledge and expertise to a dialogue that was intended to extend and develop pooled thinking about pedagogical and research issues.

To this end we focussed initially on the nature of dialogic teaching with ICT, the research techniques of lesson observation, interviewing and VSRD. Our aim was to develop the research expertise of the novice researchers to enable them to work as research assistants on a proposal made to a research council.

In our initial meetings, we discussed the results of the ITICT project and analysed issues associated with the research strategies employed in that project. Video of a numeracy lesson was analysed by the team with a view to developing consistency of judgement when using the theoretical observa-tion framework that had been employed on the ITICT project. A major issue was the difference between the assessment of teaching quality against external standards that we were all familiar with in our roles as teacher educators and the forms of lesson observation and analysis that we would use in our role as researchers. In our researcher role we aimed to observe in a non-judgemental manner, recording and analysing decisions and actions taken during teaching episodes.

In parallel with our work on research skill enhancement, we worked collaboratively on the development of a small scale proposal to Becta to fund research into VSRD and dialogical teaching using ICT in Mathematics and Science in KS2 and KS3.

We made full use of ICT to support the development of this proposal. Small groups worked on networked laptops to create elements of a proposal for a Becta research grant. Draft writing was merged and shown to the whole group on an IWB for collaborative refinement of the proposal. A smaller group further refined the proposal which went through final refine-

ment via e-mail the next day. The process of preparing the proposal was genuinely collaborative and should be seen as an element of capacity building.

Our aim in making the Becta proposal was to include the novice researchers as central players in a research project based on the use of VSRD. It was anticipated that VSRD would be a central technique within an eventual ESRC proposal and it was hoped that the novice researchers would become skilled in the use of this complex set of research techniques through the Becta project, strengthening our team's claim to expertise in this area.

While we awaited the outcome of the Becta proposal, each of the novice researchers set up an opportunity to use VSRD as a research tool with their teacher-training students before our next meeting. Lessons were video-recorded by the novice researchers. Video-recordings were left with the student teachers to be watched and analysed in preparation for a reflective dialogue when the researcher returned.

These observations were designated as research visits and not assessment visits. Assessment visits to these students were conducted by substitute observers. The usual ethical guidelines were followed, including confirmation of voluntary informed consent on the part of student teachers, pupils, schools and parents.

During these observations, the novice researchers explored the issues associated with the use of our theoretical framework and the practical problems associated with video recording classroom action, taking contemporaneous research notes and triangulating observations.

Issues that had arisen were discussed with the whole team in our next meeting. Video-recorded lesson segments were then analysed by the whole team using the ATLAS framework (Kennewell et al., 2008) and judgements were moderated through discussion.

In March, we received confirmation that we had been successful in gaining £20,000 from Becta. The project was to run until December 2008.

During April, the novice researchers conducted VSRD interviews with teacher training students and analysed the results. These were discussed in the final team meeting. The discussion operated on three levels (i) the impact of VSRD on the professional development of the student, (ii) the efficacy of VSRD as a research tool, (iii) the research skills that had been developed by the novice researchers in the process of doing the research.

The results of the i-ped project were reported at the WERN colloquium in May. At this point it could have been considered that the i-ped project had achieved its main aims, however, gaining funding from Becta has

enabled the team to continue its work on our research focus and in capacity building. The team plans to publish at a number of levels and has a programme of ongoing work.

Project outcomes

Successful outcomes include:

- the development of research skills by novice researchers;
- pilot work on VSRD by novice researchers;
- support for publication by novice researchers based on their pilot work;
- participation in collaborative research proposal writing;
- success in gaining funding from Becta;
- ongoing collaborative research into dialogical teaching with ICT in Mathematics and Science in KS3 and KS4 using VSRD;
- ongoing developments in the theoretical framework to be used in an eventual ESRC research proposal;
- ongoing development work on an ESRC proposal.
- improved quality in our initial teacher education and training courses based on our enhanced understanding of the ways in which ICT can support dialogic teaching and video resources which can be used on our courses.

The project has been very successful in meeting its aims. Research capacity has been developed in the three collaborating institutions in several ways and funded research is ongoing beyond the end of the WERN funding period.

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