Using Video Dilemmas to Encourage Reflection in Mathematics Student Teachers

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Abstract

Teacher educators continue to seek better ways to connect the theoretical and practical aspects of teacher training courses. Multimedia case studies are increasingly being used with this in mind. This paper describes the development and use of short video-based case studies with the aim of developing student teachers’ skills of reflection and critical analysis. The use of two clips with two groups of student teachers is then reported.

Introduction

Student teachers often comment that the university aspects of their teacher training course are too theoretical and that they have little impact on their classroom practice. Teacher educators continue to seek better ways to connect theoretical and research based materials with the complex and dynamic experiences student teachers gain in classrooms. One way of doing this is by encouraging the student teachers to become more reflective and critical about their own practice in the classroom: how they plan, what resources they use and how they respond to students. These reflections should draw both upon the theory encountered on the course and their past experiences in classrooms. This paper examines the use of a
small collection of short video-based case studies with student teachers with the aim of
developing their skills of reflection and critical analysis.

Technology has supported the evolution of case studies in teacher education, moving from
text-based case studies such as those developed by Shulman and Silverman et al. to
interactive multimedia resources, frequently Internet based (Hewitt, et al., 2003). Video
case-studies offer a rich, authentic setting yet there is little evidence of the outcomes of their
use (Stockero, 2008). The design of many of these case studies has focused on enabling
student teachers to reflect upon a variety of aspects of teaching: model lessons given by
experienced teachers; individual pupils engaged in learning activities; groups of pupils
working together and so on. The use of case studies is often seen as an effective tool for
bridging the gap between theory and practice (Shulman, 1992; Silverman, et al.,1996;

The demands placed upon student teachers when they enter a classroom can be daunting
and the search for effective strategies to support student teachers with these demands
continues. Decisions made during lessons are often spontaneous or habitual and
consequently rarely the product of careful thought and consideration. Student teachers need
time and opportunities to reflect upon both the behaviour of experienced teachers and their
own teaching on placement. Reflection is believed to be key to the improvement of teaching
and learning, and teacher educators need to support their students in learning how to reflect
on their own practice.

Case studies are usually designed to stimulate discussion between participants with differing
interpretations. Merseth identifies three purposes for case studies: as exemplars; as
opportunities for the analysis and evaluation of different perspectives and possible resulting
actions; and finally as stimulants for personal reflection. Exemplar case studies offer an
opportunity for teachers to see what might be possible and are particularly effective when
they differ from the teacher's own practice, but have been criticised as encouraging the user
to adopt the role of detached observer (Hewitt, et al., 2003). The case studies discussed in this paper focus on encouraging student teachers to both analyse differing perspectives and possible resulting actions, and reflect upon their own pedagogical decisions and beliefs. Cases which reflect the problems and challenges inherent in teaching are more effective in achieving these aims. Harrington further argues that case studies based on dilemmas enable student teachers to evaluate alternative responses, consequently becoming more aware of the absence of 'correct' responses, and hence will further their professional reasoning. In particular the student teachers’ understanding of the relationship between the context, theory, practice and moral aspects of teaching will develop. The ability to compare and contrast different perspectives when making decisions in teaching leads to more thoughtful and reflective action and is crucial in the professional development of teachers. However, simply viewing these videos will not necessarily result in student teachers challenging and adapting their personal beliefs or practices (Hewitt, et al., 2003).

When student teachers first enter a classroom they tend to focus on the behaviour of the teacher and then later on their own behaviour in the classroom. Shifting this focus to their students’ learning is considered vital in the long-term development of effective teachers (Hiebert, et al., 2007). Some authors argue that student teachers need to focus on their own behaviour before they begin to focus on their students’ thinking, whilst others (Levin, et al., 2009) detail examples of student teachers who are able to attend to student thinking during the early stages of their training. The focus of many student teachers at the beginning of their training is on developing routines and strategies to manage the behaviour and learning of their students, and lesson plans detail strategies designed to minimise the opportunities for misbehaviour. The challenge for the teacher educator is to provide some of these strategies whilst encouraging the student teachers to adopt a critical perspective on those strategies, revealing the complexity and ambiguity of teaching. Many of the video clips developed in this study focus on students’ learning and for each video clip, three or four strategies for responding are offered. The intention is to make this complexity and ambiguity
explicit and thus enable the student teachers to view each strategy from multiple perspectives, including those of their peers.

The research on teacher reflection is varied and extensive, particularly recently with the emphasis on the development of teacher as researcher. Student teachers and experienced teachers frequently informally reflect on their own teaching and the cause and effect relationships that they perceive (Santagata, 2009; Sherin, et al., 2009). Student teachers' reflections and interpretations are usually based on their own personal beliefs about teaching, learning and learners. Additionally their own understanding of mathematics and the different ways in which it can be represented and organised for the purposes of teaching can also inform and constrain their thinking. Professional development occurs when these beliefs and understandings are modified, adapted and reconstructed, yet this rarely happens in initial teacher training courses.

Kagan’s review of the literature identifies five components central to professional growth and reflection in student teachers: an increase in metacognition; acquisition of knowledge about students; a shift in attention from the actions of teaching to the learning of students; the development of standard procedures; and growth in problem solving skills. Whilst knowledge about students and a shift of attention to student learning are best supported through classroom experiences and interactions with students learning mathematics, the use of video case studies can support development in all five areas. With the videos developed in this study, the focus is on the development of problem solving skills and an increase in metacognition, though growth in all five areas is expected.

Many of the key articles concerning teacher reflection focus on the individual teacher, yet recent research indicates that a focus on the development of teacher reflection within a community of teachers, or student teachers may have more influence on their professional growth. Barnett found that generating, hearing and critically examining different responses in a community of teacher supported experienced teachers in re-evaluating their personal
beliefs. Situative perspectives argue that social interactions significantly change both what is learnt and how it is learnt. Learning is seen as enculturation into a community of practice through participation in both the discourse and the practice of the community. Hence learning to teach is about coming to behave and talk like a teacher, not collecting the knowledge, skills and procedures associated with the practice of teaching. Student teachers usually have very limited experiences of teaching other than from the perspective of a learner, and also do not have their own classrooms and rely on professional placements in schools to situate their learning. Yet whilst school-based learning provides an authentic setting in which student teachers learn the art of teaching, this learning usually involves the enculturation into the community of teachers working in the placement schools. If we want to challenge or develop the existing practices of teachers and student teachers, then the university setting in a community of their peers, may be more appropriate. Through using the video clips developed in small groups of their peers, it is hoped that the student teachers will analyse (and in some instances challenge) some of the practices and discourses they have encountered in schools. Additionally, working in small groups offers an opportunity to collectively generate responses which may not have arisen through individual reflection.

**Method**

Ten case studies were designed through discussions with teachers and subject mentors in partner schools. Each case consists of a vignette setting the scene and containing a staged dilemma. All dilemmas are specific to mathematics classroom; some focused on particular difficulties within mathematics such as “why does a minus times a minus make a plus?”, whilst others focus on the application and enjoyment of mathematics such as “when am I going to use this?”. Each dilemma is acted out by a teacher and a small group of their own pupils. The vignette is then followed by a pause during which students are asked to note down their immediate personal reactions and what they might do if confronted with the scenario in their classrooms. Three or four possible responses, again acted out by the local teacher and their pupils, are shown. These responses were based on the results of a survey
of mathematics teachers, student mathematics teachers and teacher educators in the UK.

Students then spend a short time reflecting upon the different responses before discussing
the entire case in small groups. During this final stage, students can co-construct other
possible responses. The aim of this resource is to raise the student teachers’ awareness of
their own reactions, then confront and challenge these reactions and their developing beliefs
and pedagogical practices by considering and comparing alternative reactions.

Originally twelve dilemmas were devised by a group of mathematics teachers and
mathematics teacher educators. These twelve dilemmas were then sent to mathematics
teachers, student mathematics teachers and mathematics teacher educators in the UK and
they were asked how they would react to any three of them. The responses were then
collated and the original team met to choose which ones should be included in the video
clips. Responses that were very common were included, as were responses that stood out
as being a bit different from others. We also included some responses which originated from
our own experiences of observing teaching because they offered a window onto possible
examples of good practice, poor practice or innovative practice. Only ten of these dilemmas
were considered to be of sufficient quality to be included in the final DVD.

The video clips themselves are very short and the contextual information available kept to a
minimum with the intention that the student teachers would explore how different contextual
features may impact the causes of the original dilemma and the possible reactions by the
teacher. Likewise the teachers who were acting out the videos were asked to act each one
as if they believed it was a genuinely good response no matter what their own personal
opinions were. In all six teachers volunteered to be filmed. These teachers had a wide
range of teaching experience, ranging from twenty years in the classroom to a newly
qualified teacher. All the teachers were mathematics teachers and two were heads of
department. The schools and students varied significantly and included schools from both
affluent areas and areas of high social deprivation, schools with both high and low numbers
of ethnic minority students and schools with both high and low numbers of students with special educational needs. These variations are clearly reflected in the video clips.

Two of these clips were then used with two groups of ten and eleven student teachers towards the end of their initial teacher education course. The student teachers knew each other well and were accustomed to working in groups ranging in size from six to twelve as the entire course is taught in this way. The student teachers were approaching the end of their second and final professional placement in school and were currently teaching full time in schools. The use of the video clips occurred on a call-back day a week before the end of their placements, where the student teachers spent one day in the university with a view to encourage them to continue their journeys as developing teachers as they move into full-time teaching posts next year.

The first video-clip shows a teacher asking students to come up to the board to answer questions involving the addition of fractions. One student incorrectly adds two fractions by adding the numerators and the denominators. The second section of this clip offers four possible reactions. Firstly the teacher goes on to demonstrate that adding numerators and denominators does not work giving the example of adding a half and a half concluding then that the students’ answer cannot be right. The second response shows the teacher moving on to the next question as if not noticing the mistake until a different student asks if the first answer is correct at which point the teacher grins. The third response involves the teacher saying it is wrong and then offering the mnemonic ‘smile and cross’ and shows them how to do it. The final response shows the teacher getting cross and reminding the students that they have to make the denominators the same before adding them.

The second clip shows a class working in silence on a set of twelve questions written on the board on expanding and factorising quadratic expressions. After a minute of watching the class work a student shouts out “maths is boring”. The second section of the clip again offers four reactions. The first shows the teacher saying that maths isn’t boring and it’s up to
the student to make it interesting. The second shows the teacher getting angry and telling the student off for shouting out. The third shows the teacher talking about some real-life applications of mathematics and finally in the last response the teacher apologises and suggests that he will try to make the lesson more interesting next time.

Each group discussed each clip for around fifteen minutes. The discussions that followed each section of the video clips were audio recorded and transcribed. The role of the facilitator was solely to control the playing of the video and the collection of consent forms.

**Results and Discussion**

Qualitative methods were used to analyse the transcripts of the discussions. The transcripts were initially coded using a framework developed by van Es and Sherin. This framework consists of five categories: Actor, who the comments focused on; Topic, which includes mathematical thinking, pedagogy, classroom management and other; Stance, which includes describing, evaluating, interpreting; Specificity, specific or general; and finally video-focused or not. This coding evolved during the analysis to include additional categories within Actor to include self, teachers in general and students in general. The transcripts were also examined for occasions where the student teachers offered justifications for their evaluations. The transcripts were coded by two researchers with both researchers coding the transcript from the discussion one group had following one of the video clips. Differences between the codings were discussed and resolved using other examples of the relevant codes in the data.

This data analysis revealed two key findings. Firstly the number of comments that focused on the students in the video or students in general increased in the discussions following the second section of the video clip concerning the addition of fractions, 0% to 25% for the first group and 15% to 27% for the second group, whilst they decrease with the video clip concerning the maths is boring comment, 37% to 8% and 19% to 13% for the second group.

In the video clip concerning the addition of fractions 67% of the comments from the first
group focused on the mathematical nature of the error in adding fractions though this figures was only 17% for the second group. In contrast, all the student teacher comments from both groups following the maths is boring reactions focused on the behaviour of the students. The majority of comments following both sections of the maths is boring clip focused on what they themselves would do in that situation, 55% before and 52% after for the first group and 55% before and 43% after for the second group.

The proportion of comments that focused on what the student teachers would do is perhaps unsurprising as this was what they were asked to do. The proportion of comments focused on students is more interesting. Student teachers often focus on the behaviour of the teacher and making the transition to focusing on student learning, and then altering their behaviour in light of what they learn about their students is often challenging. The use of the adding fractions has demonstrated that the transition of attention to student learning can be supported using video case studies. When examining student misconceptions, the use of case studies and peer discussion offers student teachers the time to explore the origins and consequences of different mistakes and misconceptions. The disparity between the two groups on the nature of the comments which focused on students suggests that it is not the clip itself which encourages the focus on student learning but the composition of the group and the role of the facilitator. Much of the research on using case studies to encourage student teacher reflection has focused on written reflections by individuals, yet the results in this study suggest that using cases in group discussions can lead to greater attention on student learning, a key component of professional growth.

The second finding revealed that the stance taken altered between the first and second sections of the clip. For the adding fractions clip the number of evaluative comments decreased from 100% to 79% for each section of the clip respectively, whilst for the second group, 50% of the comments following both sections were evaluative. For the maths is boring clip the number of evaluative comments increased from 55% to 82% for the first group and from 63% to 67% for the second groups. For both groups the numbers of
interpretive comments was small, in fact only one comment made by the second group after the second section of the maths is boring clip was coded as interpretative. These indicate that no there is no clear effect on the stance when the student teachers are shown possible responses. Although the first group made more evaluative comments on both occasions, there was little change in the second group. However, a closer examination of these evaluative responses reveals that before the second section of both clips the student teachers made no attempt to justify or support their responses or offer explanations of their opinions. After viewing the recorded responses over 50% of the comments from both groups included justifications or explanations, and many comments built on answers offered by their peers. This shows a move towards an more interpretive stance (Heaton 2000; Putnam & Borko 2000; Rodgers 2002) and an awareness of the possibilities to challenge and improve their intuitive responses. Responses that offer no justification or explanation are often based on the student teachers beliefs about teaching and learning rather than evidence from experience or research. It is disappointing that there were so few interpretative responses. Teachers should consider the implications and consequences of the decisions they make on student learning but also with respect to the wider issues of social justice. These video clips may support this transition to a more interpretive stance if the facilitator supports the student teachers in considering the implications of their reactions.

The two types of clip discussed here have resulted in group discussions that differ in terms of actor and stance, suggesting that the intentions of the teacher educator using the clips need to be explored. If the aim is to develop student teachers’ attention to student learning then clips which focus specifically on mathematical mistakes and misconceptions may support this aim. If the aim is to encourage student teachers to consider the implications and consequences of decisions made in the classroom then the more generic pedagogically based clips may offer more support. Further research is planned with the remainder of the clips to explore any wider implications their use may have.
Conclusions

The preceding study methodology aimed to explore the intuitive responses of student teachers to classic mathematics teaching dilemmas and how these are altered through discussion and reflection on alternative responses. The results suggest that the use of the video clips did change both the focus of the discussions and the evaluative and interpretative nature of the discussions. Initial reactions are often not carefully thought out or examined and through examining alternative reactions and discussion in a community of peers these responses are adapted and in some instances rejected. Using groups to discuss the reactions brought to light new considerations for individual student teachers and often resulted in the alteration or rejection of responses. It is hoped that these experiences will raise the student teachers’ awareness of the possibility of alternative reactions when they react in their own classrooms.

It is important to note the limitations of this study. The video clips used were clearly staged, a challenge to the authenticity of the clips, but also although these offered the student teachers the opportunities to examine different responses, there are no opportunities to see the outcomes of each approach on the students. There were also no opportunities for the student teachers to explore the origins of the dilemma through student questioning or contextual information. In the reality of the classroom, these contextual factors can have a significant impact on the choice of reaction. The limitation of any case-study approach is the authenticity of the case and the extent to which they can represent the dynamic and complex nature of the mathematics classroom.

In spite of these limitations, case studies do appear to have a beneficial effect on the reflection, critical thinking and decision-making skills of student teachers (Barnett, 1998; Moje & Wade, 1997; Sherin, et al., 2009). They also allow the student teachers to develop these skills in the relative safety of their peers, where responses can be altered or rejected and the consequences of their responses are theoretical.
This research is motivated by a desire to encourage student teachers to develop their reflection-in-action and reflection-on-action skills. The use of video clips specifically developed with this purpose in mind was explored and potentials for developing both student teachers’ reflections on student learning and developing an interpretative stance on decision-making were revealed. Further research is planned to explore and evaluate these potentials further.

Bibliography


*This document was added to the Education-line collection on 11 September 2009*