

Teaching and Learning Science through Student-made Videos

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ABSTRACT

Digital video is an exciting emerging technology that can be used in schools to support, extend, or change pedagogy and curriculum outcomes. This paper outlines the results from a recently completed research project that investigated the use of student-made digital videos across the class K to XII curriculum in five schools of Bokaro, Jharkhand. This paper particularly examines the teachers' rationales, students' learning outcomes and the ways in which pedagogy was enhanced in the schools through the use of student-made digital video projects.

KEYWORDS: Communication, Digital Video equipment, Mobile camera, School Computer, Windows Movie Maker (software)

Introduction

Recent developments in information and communication technologies (ICT) are starting to impact the teaching and learning that takes place in schools. In particular, the use of digital video is increasing in classrooms. Video usage has been common in schools for over a decade, but the digital aspect allows editing and annotating in ways that were not previously possible in classrooms.

One new development in the pedagogical use of digital video is student-made digital video, which provides students with opportunities to act as scriptwriters, camera crew, editors and directors. Ease of use of recently developed editing programs allows students as young as six years of age to assume some of the roles described here.

This paper considers the pedagogical implications of students generating and editing their own digital video in the

classroom. Five case studies of schools and classes using digital video (DV), in which students chose their topic, scripted the video, filmed and directed it, were considered. This paper gives an overview of the findings and some implications of this study. Firstly, an outline of relevant research in the area is provided followed by details of the study. We end by suggesting a model of good practice arising from the study.

The study described in this paper sets out to gain a deeper insight into these areas.

The Study

Our study sought to gain an understanding of the way that teachers and students interact and learn in class rooms in which practice using student-made digital video occurs.

Research Questions Relevant to this Paper

The following are the research questions that served as a framework for the interpretation of the data discussed in this paper:

- What are teachers' rationales for using student-made digital video in their classes?
- What is the nature of the learning outcomes in student-made digital video use in various curriculum areas?
- What pedagogical approaches are being used with this new technology?

Materials and Methods

Participants

9055 students from five schools participated in the study during 2011-2015. Five case schools (CBSE + State Board) were selected across K-12 (ages 5 to 17) so that there were both primary and secondary schools and a range of curriculum areas and pedagogical contexts for the use of the technology.

Data Collection

Each school was visited on a minimum of two days by at least two members of the research team, which comprised the two authors and two research assistants. Data were collected in a number of ways.

a. Initial open-ended questionnaires were given to teachers and administrators to collect demographic information and views about administrative structures, and to probe rationales for use of student made DV.

b. Observation of lessons was conducted using a semi-structured observation schedule. Video of class activities was also taken.

c. Interviews were held with teachers, administrators and selected students in focus groups. Students were selected for these interviews by means of purposeful sampling. They were the students who had been involved in the production of video clips as part of their school curriculum.

d. Artefacts made by the students were collected as well as school documentation about ICT management, rationale and use.

Analysis

The story of each case school was constructed and developed from multiple sources of data by one of the researchers who had visited that school. Each case was written with the research questions in mind and data that informed the questions were used in the case construction. The case was then read and checked by other researchers who had visited that school. Reference to raw data on video and audio tape was made in the case of disagreement about any aspect of the case. On completion of the five cases, the case stories were then examined by the researchers (like Principal and other school teachers) for trends and differences amongst the case schools. A set of categories emerged from this examination. The research questions were used as the focus for this categorisation.

Findings

An outline of the findings concerning teacher rationales, learning outcomes and pedagogical approaches follows. These findings

indicate that well-designed, student-made digital video tasks are strongly aligned with principles of independent, authentic learning. These tasks share characteristics of being student-centered, context-rich and encouraging active group participation. Such tasks in this study were seen to provide students with flexibility and choice, usually creating a strong sense of ownership, self-regulation and contributing to self-esteem benefits and personal interest in topics. Students projected their personalities in unique, creative ways, particularly when they were aware of their peers as the target audience for their productions.

Teacher Rationales and Modes of Use

Most of the teachers in this study initially started using digital video for their own use, and during this process became aware of the value of the tool for their students. In this way, their classroom use of DV was often an extension of their personal interest in digital movie making. There was a strong teacher belief that DV work could lead to independent, active group learning and facilitate student creativity and an experiential approach to learning. They were mindful of the seductive nature of the video medium for students and the potential for subsequent engagement when students generate their own productions (particularly amongst reluctant learners). They were also aware of new digital literacy skills learned through DV work as well as the potential for authentic assessment and informative reporting. These expectations were generally strongly aligned with the students' learning outcomes from their lessons. Teachers also mentioned the value of generating deeper conceptual understanding of curriculum topics, although this was not noted as strongly in the learning outcomes that emerged from the DV tasks.

Modes of use of student-made digital video projects

The study identified three main modes in which teachers used student-made digital video projects. Over six hundred different student-made digital video projects were part of the data in the study and these projects were used as learning tools in the following distinct modes (see Table 1):

Mode 1: DV was used as a communication tool to facilitate students' communication of a message, idea or information;

Mode 2: DV was used as an observation and analysis tool to enhance students' observation and analysis of performance or phenomena;

Mode 3: DV was used as a reflection tool to support students' reflection on their own learning.

Table 1: Summary of Modes of Use of Student-made Digital Videos from Study

Mode/ Purpose	Elaboration	Examples/ Performers	Audience
<p>Mode 1: Communication Tool to empower learners to express and communicate ideas, feelings and information.</p>	<p>Tell a story. Teach/model a concept or skill. Show a model/simulation/demonstration. Present research findings. Present a role play or drama performance. Report on special event (excursion, guest speaker, graduation etc.). Promote subject/class/school. Promote culture (e.g. for cultural exchange by language learners). Support discussion in online communities.</p>	<p>News, documentary, press conference, cartoon, satire, talk show, music clip, advertisement, game show, drama, review, investigative report, animation, Claymation, instructional, biography.</p> <p>Main performers: Self, peers, Inanimate objects (e.g. puppets, Claymation figures)</p>	<p>Peers (small group, class), teacher, school community (parents, other teachers and students from other classes), local & wider community</p>
<p>Mode 2: Observation and Analysis Tool to observe, analyse and gain feedback on a performance or phenomenon. To aid learners'</p>	<p>Use of video facilities (slow motion replay, 'toggle' etc.) to make sophisticated observations of a performance or phenomenon. Possible use of video analysis software to make measurements and further analysis.</p>	<p>Feedback on performance tasks such as public speaking, drama productions, psychomotor skills etc. Observation and measurement of natural phenomena, such as analysis of motion. Main performers: Self, peers, inanimate</p>	<p>Self/peers/teacher</p>

observations, measurement & analysis		objects (e.g. natural phenomena).	
Mode 3 Reflection Tool To facilitate learners' reflection and metacognition	Students review and reflect on their learning through the lens of the camera. Students build up a video-based record of their learning over time (i.e. for their own future use)	Video based journals like blogs, documentary, etc. Inclusion of clips in e-portfolio. Main performer – Self	Self/teacher

The majority of projects from the data in the study (100% of cases) involved students' use of DV as a communication tool: students built their videos to basically 'tell a story' or relay messages, ideas or information. The mode 1 projects often involved students acting in roles in a variety of film genres such as news items, interviews, advertisements, and music clips. Sufficient data were collected from mode 1 uses to establish a model of good practice for DV projects used to 'communicate a message' (this model is discussed later in this paper).

Far fewer cases in the study involved using DV to facilitate students' observation and analysis of performances and phenomena (23% of cases) or to enhance students' reflection skills (12% of cases). One school was using student created DV clips as a reflection tool in conjunction with digital portfolios while another school planned to use student clips as a basis for a video-based learning log. Further studies are needed to investigate these less common uses of DV tasks (modes 2 and 3) and explore links with authentic pedagogy and assessment.

Sample Mode 1 Uses: Student-made DV with a 'News Production' Context

We observed many mode 1 uses of student-made DV projects across most KLAs over the five case schools (see Schuck and Kearney, 2004b) for a detailed description of over seventy examples). In the following two examples, students used a News Production context in their video project work.

The first example involved approximately 20 senior primary students (all volunteers) who formed an editorial team that prepared and published weekly news items on the school's intranet for the school community. The team met regularly to discuss possible items and wrote about the things that were happening in the school. The students were responsible for both content and technical production and did their own filming, editing, spell checking, etc. The children had a variety of roles, including technical officer, interviewer, writer of technical tips and sports reporters. Video clips were used to capture a variety of school events and students used iMovie and Windows movie maker to edit their videos, including commentary and text additions. The level of teamwork was high, there were clear roles and the students were generally independent in these roles. The students appeared to receive minimal support from the teacher or librarian and indeed, their teacher perceived her main teaching role as a 'sounding board' for students. The children involved in the project were keen to expand it and link up with other schools around the world to share surveys, videos and make comparisons.

Results: Student Learning Outcomes

A variety of learning outcomes emerged from the study and they are summarized in Table 2. The following outcomes were evident in most cases in this study: development of movie-making skills and related language development, development of media literacy skills, communication and presentation skills, metacognitive and affective skills. In tune with the teacher beliefs, students displayed highly impressive levels of autonomous behaviour, engagement and motivation.

Indeed, there were overwhelmingly strong data to support the claim that students were on-task and motivated during their DV tasks. This motivation occurred most particularly when students had designed and implemented a task of their own making, rather than one designed by the teacher. The value of student ownership was apparent in these tasks. Students enjoyed the opportunity to project their personalities through their projects – particularly when their peers were the target audience. This potential to creatively 'illuminate their own characters' via

these DV projects seems to contrast with many traditional, paper-based class tasks (at least, as perceived by students) and may help explain why many students told us how this type of work contrasts with their usual class experiences.

Table 2: Summary of student learning outcomes from DV projects in the study

Students Learning Outcomes	Elaboration
Domain specific conceptual and skill development	Concepts and skills relating to specific curriculum areas such as science, mathematics, creative arts, etc.
Movie making skill development and related language development	Storyboarding, film technique, editing, publishing, etc. and use of associated jargon
Literacy skills	Include media, visual, cultural and critical literacies
Communication and presentation skills	Oral, written, reading, listing, visual, Acting skills, Interviewing skills
Organisational and teamwork skills	Organizing and planning skill, managing, leadership, negotiation and social skill
Higher-order thinking skills	Problem-solving, reasoning, analyzing, creating and questioning skills
Metacognitive skills	Becoming aware of how one learns, reflection on own learning.
Affective Skills	Enhancement of self esteem, risk taking, value of subject, appreciation of films, care of equipment, responsibility

However, compared with other outcomes in Table 2, we noticed relatively low levels of rigorous conceptual development relating to curriculum outcomes. Indeed, we collected data that indicated that the technology was sometimes impeding these outcomes. One example of this occurred in a class 8 mathematics class, where students were filming the motion of a model car

down a slope to graph the motion. Much attention was paid to the filming and associated aspects, but little or no attention was paid to the graphing or development of related concepts. In light of this type of data from the study, the following features emerged as crucial for student made digital video tasks with the primary aim of facilitating rigorous conceptual development in any curriculum area:

- *Assessment needs to be properly aligned with these intended learning outcomes. If conceptual development is an intended outcome, then students should be able to demonstrate this development through something like a learning journal or at least using their own words and answering questions during their final presentations. Formative assessment (e.g. at the storyboard stage) is also important here.*
- *Students need to be familiar with and develop necessary teamwork skills to engage in these projects effectively and without being distracted.*
- *Students need some movie-making skills and a basic understanding of the 'language of the medium' for the technology to be seamlessly integrated into the learning process. School ICT coordinators need to confront this issue using some sort of development program in younger years before endorsing use of student made DV tasks across the curriculum for concept development.*
- *Students need an opportunity to 'celebrate their learning' in the crucial presentation stage of the project by articulating their learning and discussing underlying concepts from their films.*

When these conditions were met in our case studies, the DV tasks would 'sharpen the focus' of students on underlying concepts in the film and related curriculum outcomes ensued. This development was often concurrent with a similar progression of students' personal interest in the subject matter being studied. The DV tasks facilitated the expansion of students' initial, extrinsic interests (including novelty), to deeper,

personal interests in the topic. For example, a task which promoted such understanding was observed in a class 3 (8-9 year olds) where students were studying human virtues by scripting and filming a video in which they portrayed a particular 'virtue' and its benefits to others. Students had been thoroughly taught how to script, film and edit and this allowed them to focus on the virtues and not the process of making the video. An important part of the learning process was the final stage in which the students presented the work to other classes in the school to further discuss and illustrate their chosen virtues and to encourage others to demonstrate these virtues themselves.

In summary, students in this study enjoyed unique opportunities to 'find a voice' and creatively project their personalities through their DV tasks. They were acutely aware of the intended audience and seemed to be most motivated by their peers as the target audience. A range of learning outcomes were evident in the study, including strong indications that students were developing movie-making skills, some forms of digital literacy such as media literacy skills, communication and presentation skills, metacognitive skills and some affective outcomes such as self esteem development. There was limited evidence of rigorous conceptual development relating to curriculum outcomes.

Pedagogical Approaches

The major areas in which pedagogical approaches tended to differ from those in other lessons are as described below:

- *Teacher roles tended to be more instructors on technical skills than on content.*
- *Students had more independent roles, deciding in some cases, on whether to use digital video, then scripting and directing as well as acting in their videos. They also seemed to take responsibility for dissemination of the videos in presentations.*
- *Peer and group learning was evident in all cases, and this appeared to be a given aspect of each activity, possibly because of the nature of movie-making*
- *Authentic learning opportunities were strongly evident and this was a major finding of the study. The authenticity was*

apparent through the ability of DV to be used in real-world contexts; to develop life skills; and to be produced for a real audience.

- *Assessment, in terms of student self-assessment and teacher observations, was noted as differing from more traditional assessment practices.*

Many teachers encouraged the students to take a playful approach to their filming and editing and set up very open-ended activities for them to discover their own mistakes and learn from them. The immediate feedback students received when they reviewed their films, as well as the ability to later edit their mistakes, helped students and teachers feel comfortable with this open-ended approach to learning. The autonomous style of learning supported by these open-ended tasks required a significant degree of flexibility from the teacher as students created their own learning pathways at their own pace.

A strong theme to emerge in the study was the authentic nature of the DV tasks given to students. These tasks were designed to encourage students to consider real-world, interesting contexts and also develop useful, current skills and communicate through a contemporary medium. Once again, the awareness of peers as the target audience was motivating for students, encouraged them to use their own humour and generally enhanced the authentic nature of their learning experiences. Indeed, in light of this awareness of their peers as the intended audience, many students appreciated using DV as a medium for their class presentations, allowing them to feel more relaxed and confident in their presentation. Assessment also was underpinned by this authentic theme and included self assessment practices, and use of e-portfolios. Teacher observation and frequent feedback throughout the production process was also important.

Emerging Model of Good Practice for Mode 1 Digital Video Projects

Data were collected from a variety of stages in the production process of mode 1 DV Tasks (discussed previously) as students made movies to ‘communicate a message’. These stages ranged

from the initial brainstorm and storyboard stages through to the important presentation and dissemination stages. Principles of good practice subsequently emerged from these data. These principles include suggestions for teaching strategies and peer support structures at each stage of the mode 1 DV production process. However, as noted earlier, insufficient data were collected from modes 2 and 3 uses of DV to support claims of good practice and this should become a direction for future research.

At the initial development of ideas and storyboarding stages, teacher scaffolding and modeling were important. For example, some teachers in the study used segments of past students' work or commercial movies to make pertinent points, spark ideas for new projects and model appropriate language. A wide degree of choice here enhanced student ownership of their projects as discussed previously. Choices of content, roles and even film genre, were motivating. The choice of student peers as the target audience was a major source of motivation and encouraged use of humour and appropriate language in the final productions. Mind maps and other organizers were used as planning tools to brainstorm ideas for storyboards. Students were made accountable for their final storyboards and were prepared for 're-storyboarding': editing and re-editing their plans before filming. For example, students in one class in the study had a requirement that they had to 'sell' their storyboard to their teacher (the director) (i.e. persuade their teacher of its worth) before they could start filming.

In the filming and editing stages, roles were rotated and a peer expert system was useful for students in the sometimes technically challenging editing stage. In one primary school, widespread use was made of 'peer mentors', children who had learned how to edit, or make Claymations in a previous class, and were the experts in the class to whom students were directed for assistance. At this filming stage, teachers of younger children supplied extra scaffolding such as issuing their children with teacher-made 'media elements' for their films. For example, one teacher lent considerable help to her K children (5 to 6 year olds) at this stage of the process. Small group reflection and informal peer assessment of films also was encouraged at this stage to promote quality products.

Perhaps the most important data in this part of the study concerned the final stages of the DV project: ‘celebrating’ and sharing the students’ final products and conducting discussion around these artefacts. These presentations provided significant opportunities for meaningful class discussions centred on the intended learning outcomes of the projects. The importance of the teacher’s role here in mediating and directing this discussion cannot be over-emphasised; potentially these discussions (and subsequent reflections) determine the overall quality of project learning outcomes. Dissemination and publishing of student products needs serious consideration and a number of outlets emerged, including school film festivals, student-led conferences, external film competitions, international cultural exchanges and TV shows.

Formative assessment procedures are recommended in almost every stage of our model. These include peer assessment and encouragement of group discussion and sharing of perspectives at all stages of the process, including the use of online filming communities for this purpose. Teacher observation and feedback is also crucial, especially in the important early stages of the process. For example, to assess language development, teachers need to be active observers of students’ learning conversations and writings.

Discussion

This paper outlines some of the findings of a project on student-made digital videos. The project provided an in-depth view of the pedagogies, beliefs, approaches and school contexts that exist when students are given the opportunity of using student-made digital video to create their own videos.

Findings of significance were the following: the authors saw clear evidence of student-made digital video strongly enhancing pedagogy in the area of student engagement and autonomy. We noted the value of the audience in focusing student activity, and also found that student voice and ownership were key factors in enhancing the learning process.

A suggestion arising from the study is that more emphasis is given to the development of conceptual understanding through

the use of DV, and that this area is researched further. Three major modes of classroom use were identified, namely: as a communication tool (mode 1); as an observation and analysis tool (mode 2); as a reflection tool (mode 3).

It was found that most projects in the study could be identified as being mode 1 usage. Modes 2 and 3 did not seem to be used as frequently as would be expected, given their importance in learning and teaching. The research study also benefited from insights into the pedagogies used in the case studies. Principles for good practice in mode 1 projects were developed from the data. Key principles included the importance of ongoing self, peer and teacher assessment and also the importance of celebrating student products through presentation and discussion.