Implementing Digital Storytelling as a Technology Integration Approach with Primary School Children

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Abstract

Irish educational policy acknowledges the importance of integrating technology meaningfully into teaching and learning at the primary level. Much remains to be done, however, in terms of developing, practically implementing and evaluating the use of technology in the Irish primary classroom. This paper describes a study on the use of a structured approach to digital storytelling as a tool for meaningful technology integration with children at primary level. In this study, the researcher developed a structured approach for implementing digital storytelling with primary school children, and collaborated with a class teacher in an Irish primary school to prepare to implement the approach. Multiple qualitative methods were used to evaluate the implementation, including interviews with the teacher, classroom observation, and focus group interviews with participating children. The results suggested that this structured approach to digital storytelling has the potential to be used successfully as a meaningful technology integration approach with this cohort. The findings also explored implications for the implementation of digital storytelling at primary level, and identified aspects on which further research should be undertaken to enhance and extend the approach that was used.

Keywords: digital storytelling, implementation approach, primary education, technology integration

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Introduction

Technology is seen as a critical component to be integrated in educational practice, and its role in fostering important 21st century skills is widely acknowledged (National Educational Technology Standards, 2014; UNESCO ICT Competency Framework for Teachers, 2011). In Ireland, the National Council for Technology in Education (NCTE) was established in 1998 with a view to promoting and supporting the integration of technology in primary and second-level schools. The following year, the most recent revision of the Primary School Curriculum was published, and integrating technology was stressed as a key issue:

> *The curriculum integrates information and communication technologies into the teaching and learning process and provides children with opportunities to use modern technology to enhance their learning in all subjects* (p. 29).

While the curriculum provides high-level suggestions on the use of technology, it offers little practical guidance for teachers on its effective implementation.

Since 1999, a number of government body policy and review documents have addressed various aspects of technology integration. The role of teacher training has been highlighted (Department of Education and Science, 2006), and challenges to the successful integration of technology identified (Inspectorate Evaluation Studies report, 2008). A need to change the focus of ICT integration in schools has been asserted, with a strategy group report on the vision for ICT in schools in Ireland for 2008-2013 (Morrissey, 2008) acknowledging the potential of technology to enrich teaching and learning, but stating:

> *The challenge we face is to ensure that the emphasis on ICT in schools shifts, in the immediate future, from technology provision to a focus on its deliberate use by the learner. … The pursuit of creativity and inventiveness are now pivotal skills …and the embedding of ICT in learning can greatly facilitate their development* (Executive summary, p. I).

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Since 2008, there appears to have been little in the way of review or evaluation of approaches to technology integration. Recent theses (O'Grady, 2011; Treacy, 2009) found that teachers' confidence in the classroom remained low, highlighting challenges such as time constraints, technical issues and limited training on effective approaches.

Outside of Ireland, several studies have highlighted shortcomings in existing approaches. Wang, Kinsie, McGuire & Pan (2009) maintain that technology in the classroom often focuses on a 'search and retrieval' type approach, and stress the critical role of the teacher, particularly with younger children. Robin (2008) contends that multimedia technology is being implemented "without the greater level of thought and consideration to the subject matter, the teaching strategies, and the real world needs of today's classrooms" (p.226), suggesting that further research is needed on effective approaches to technology integration. Ongoing professional development of teachers, meanwhile, continues to be raised as a leading challenge to effective integration of technology in schools (Johnson, Adams Becker, Cummins, Estrada, Freeman & Ludgate, 2013).

This paper focuses on digital storytelling as one tool to support the integration of technology in education. Digital storytelling is a way of telling and presenting stories through the use of digital media, incorporating graphics, sound and music. It is usually used to refer to short personal narratives, created using widely-available, low-cost digital media technology (Robin, 2006). In an education setting, it offers a platform for students to engage in the creation of story-based learning artifacts that can demonstrate their knowledge and creativity. As a tool for technology integration in the classroom, digital storytelling can offer teachers an effective instructional approach for enhancing learning, supporting content acquisition, critical thinking skills, both traditional and digital literacy skills, and motivating both teachers

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and learners (Di Blas & Paulini, 2013; Robin, 2008; Sadik, 2008). With the breadth of activities and roles required to create a digital story, it potentially offers an opportunity for meaningful participation of children of different levels of ability in a sustained manner. This paper describes a research project undertaken at a primary school in Dublin, where the researcher developed a structured approach for implementing digital storytelling, worked with a primary class teacher to prepare for and implement the approach, and evaluated the implementation.

The Storytelling Tradition - Going Digital

Storytelling has a rich history as a communication tool in various guises, from cave drawings, through the oral storytelling tradition in many cultures (Behmer, 2005), to its modern manifestations in visual, photographic, film and digital media. Storytelling as a technique has a natural fit with children – from the earliest ages children delight in looking at, listening to and participating in storytelling activities. Digital storytelling has much in common with traditional storytelling, with the added dimensions afforded by the digital environment. Robin (2006) defines digital storytelling as combining the art of telling stories with digital media such as images, audio and video. Meadows (2011) has described digital stories as "multimedia narratives…250 words, a dozen or so pictures, and two minutes is about the right length".

The most widely used framework for digital storytelling, the 'Seven Elements of Digital Storytelling', comes from the Center for Digital Storytelling (CDS) in Berkeley, California. The Seven Elements are suggested as building blocks to an effective digital story, and address aspects such as conveying your message, raising the key question of the story,

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engaging the emotions, the power of the narrator's voice, effective use of music, sound effects, and economy (Robin, 2013).

Digital storytelling represents a constructivist approach to learning, which recognizes the relationship between education and experience (Dewey, 1938), and asserts that children's active engagement in learning helps facilitate the construction of their own meaning (Piaget, 1977). Digital storytelling can potentially help develop the higher-order skills that have been identified with constructivist-based learning approaches, including organizational, problem-solving and presentation skills (Jonassen, Carr & Yueh 1998; Mishra & Girod, 2006).

Digital storytelling as a media-based narrative form can be traced back to the 1990s, but more recent research has explored its use in educational settings. Digital storytelling can be described as an educational tool for improving content-based instruction (Dreon, Kerper & Landis, 2011), and can facilitate improved content understanding, knowledge gains, and thinking skills (Yang & Wu 2012). Studies have found that digital storytelling plays a role in developing a sense of personal identity and culture (Burgess, 2006; Davis, 2005), and can facilitate heightened self-awareness and empowerment (Benmayor, 2008). Benmayor sees the process as transformative, saying:

> *Digital storytelling is an assets-based pedagogy where students can bring their own cultural knowledge and experience to the fore … to transform their thinking and empower themselves* (p.200).

Learner motivation and engagement have been recognized as playing a pivotal role in learning success (Herrington, Reeves, & Oliver, 2010). Research on motivation and engagement in digital storytelling has been positive, with findings indicating that students are engaged in the process, showing pride in their work and committing time to develop their stories (Dogan & Robin, 2008; Sadik, 2008).

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While research has highlighted the positive learning benefits to students of engaging in collaborative work (Barron & Darling-Hammond, 2008), there is evidence, of some challenges with collaboration in digital storytelling involving children (Sadik, 2008).

It is clear that digital storytelling has a range of potentially powerful benefits; it is less clear what type of approach is required to implement it successfully with children, and what challenges exist. The original Seven Element framework has evolved, and more recently has been reworked around the idea of more structured 'steps' rather than 'elements' (Lambert, 2010). It approaches digital storytelling largely as an adult-oriented personal narrative tool, however, and requires considerable adaptation for young children. Robin (2013) offers a model of digital storytelling that adapts the Seven-Element framework for educational use; that too is more suited for use with older students. Ohler (2008) provides guidance on creating digital stories in the classroom, emphasizing the importance of the story: "Focus on story first, technology second, and everything will fall into place" (p. 14). Ohler (2008) presents a detailed analysis of the process; however some of his suggested approaches are more relevant to older students.

Some studies have examined the process of implementing digital storytelling in a higher education context. Both Long (2011) and Maddin (2011) explored the use of digital storytelling with pre-service teachers. Lessons learned included the role of reflection, the value of self-assessment and peer review, and in-class time needed for story production.

In a middle school context, studies have explored the central role of the story in conveying meaning (Behmer, 2005), and the potential of digital stories as developmental tools for the students who created them (Davis, 2005).

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Banaszewski (2005) focused on the use of digital storytelling with 4th to 12th graders. Recognizing its origins as an adult-oriented tool, Banaszewski draws attention to the need to adapt digital storytelling for use with children. Emphasizing the need for developmentally appropriate expectations, he suggests that a digital storytelling project should include five stages: logistics and planning, script writing, teaching the digital story elements, managing the technology, and assessment.

Some research on implementation conducted with k-12 teachers and children (typically 5 to 18-years age-group) has indicated issues such as time constraints as a significant challenge, as well as limitations with technology resources (Dogan & Robin, 2008; Sadik, 2008). Dogan & Robin (2008, p.905), however, maintain that limited research exists on effective implementation in the classroom, saying:

> *There are few research studies that show how digital storytelling can be used as an effective tool in the classroom, what effects can be observed on student learning, and what kind of problems can arise in the implementation process.*

Thus, a picture emerges of the need, and the value, of providing an effective structured approach (Robin, 2008; Harris, Mishra & Koehler, 2009) that teachers can use to implement digital storytelling.

This study involved the design and implementation of a step-by-step approach to implementing digital storytelling. The key research question was: 'how effective is a structured approach to the implementation of digital storytelling in a primary school, in an Irish context?'

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Project Design

To provide a practical tool for primary school teachers, the project design involved developing a structured lesson-by-lesson approach for implementing digital storytelling. Reflecting the importance of quality instructional support for teachers (Bhatt, 2005), the design included a teacher orientation plan. The researcher developed a nine-lesson unit plan for implementing digital storytelling (Table 1), based on digital storytelling literature (Banaszewski, 2005; Lambert 2010; Ohler, 2008; Rosenthal Tolisano, 2009).

Table 1	
Digital Storytelling Unit Plan Outline	
Stage	*Lesson*
Stage 1 Technology Skills	Lesson 1: - Introducing Windows Movie Maker
Stage 2 Developing the Story	Lesson 2 – Developing the Story Idea
	Lesson 3 – Developing the Script
	Lesson 4 - Peer Review, Storyboard Development
Stage 3: Visualizing the story and gathering the media	Lessons 5 Class and group discussions on visualization; creating and sourcing media
Stage 4: Producing the story	Lesson 6 – Creating the first digital draft
	Lesson 7 - Peer review of digital drafts
	Lesson 8 – Refining the digital story
Stage 5 Presenting the Stories	Lesson 9 – Presentation of final stories to the class
Estimated total time:	Approximately 10 hrs

The decision to focus the first lesson on technology was based on Ohler's (2008) recommendation, which he argues facilitates a smoother transition from story development to production phases (2008, p.137).

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The next three lessons - allocated to the key stage of developing the story - were guided by Ohler's (2008) approach, adapted for the purposes of this project. Developing the story idea would begin with exploring the critical elements of a story (Behmer, 2005), looking at familiar stories and exploring aspects such as the need for structure, the element of conflict or tension, and a conclusion. The researcher selected examples of digital stories created by other children to support the discussion. In addition, Ohler's Visual Portrait of a Story (2008), which uses a visual map of the elements of a story, was provided as a visual illustration to support the story structure discussion.

The Center for Digital Storytelling's Seven Elements would be addressed in a simplified way with the children. To address the trait of economy, for example, the children would be given guidance on how long their stories were to be: about 2 minutes, about 10 pictures. The children would work in groups to script their stories, on any topic of their choice. After they drafted their stories, they would be encouraged to read them aloud, as they would do in the production of the story. Peer review, a technique espoused by several practitioners (Ohler, 2008; Banaszewski, 2005) would follow the first draft scripting.

The next step (Lesson 5) was visualization, guided by Lambert's (2010) focus on visualization as a key step. Development of the children's understanding of digital story elements would continue here, with class discussion of questions such as what is important about your story, and what do you want people to feel when they see and hear your story. The children could then begin to think about images that would help convey their stories, and start to select suitable images, which they could either choose from free Internet images, or draw their own illustrations.

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Lessons 6 to 9 focused on production, similar to Ohler's (2008) production phase. The groups would develop their digital stories using the production tool, adding images, narration and sound effects, along with titles and credits. They would then present their draft digital stories to another group for peer review, and make any adjustments following peer feedback. To ensure access to the necessary technology (Dogan & Robin, 2008), the researcher consulted with the school's IT support teacher. Windows Movie Maker 2.1 was chosen as the production tool, as it is freely available with the school's operating system, easy to use and reasonably powerful.

Orientation of the teacher was guided by literature on the use of digital storytelling in teacher education (Dreon, Kerper & Landis, 2011; Long, 2011; Maddin, 2011; Robin, 2008), in particular, recognition of the need to develop teachers' technological pedagogical knowledge (Harris, Mishra & Koehler, 2009), and the need for training on digital storytelling as an instructional strategy (Dogan & Robin, 2008). The orientation included exploring the digital storytelling approach, reviewing the structured approach and unit plan developed by the researcher, and familiarizing the teacher with the story production tool.

The study took place with a fourth class in a suburban primary school in Dublin. The teacher, who has ten years' teaching experience, volunteered to participate. 27 children participated. The researcher and the class teacher met over four one-hour orientation and planning sessions. Following this, minor tweaks were made to individual lesson durations in the unit plan. The teacher assigned the children to eight groups, each comprising either three or four children, in line with recommendations for structuring group work (Gillies, 2003). Implementation took place over a three-week timeframe, with the final class presentation

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taking place shortly afterwards. During the production phase, the children were occasionally given additional class time to work on their stories.

Methodological Approach

With its focus on examining the process of implementing a specific technology integration approach, with a participant group in a specific setting, a case study was considered the most appropriate strategy for this study. Robson (2011) defines a case study as "a strategy for doing research which involves an empirical investigation of a particular contemporary phenomenon within its real life context using multiple sources of evidence" (p. 136), and suggests that case studies use predominantly qualitative methods. Robson takes his lead from Yin (1994), who highlights the use of multiple sources of evidence as a key principle of case studies. Accordingly, this study used multiple qualitative data collection methods.

Data collection began on completion of the teacher orientation, with an audio-recorded interview with the teacher. The interview explored questions such as the teacher's views on the orientation and their confidence level with the approach and the technology. The teacher was then provided with a digital voice recorder and asked to record a short reflection following each lesson. The teacher was asked to focus this reflection around what went well in the lesson, what didn't go well, and any expectations or concerns about the next lesson. The researcher was present as an observer at all nine digital storytelling lessons, and took written observation notes, focusing on aspects such as lesson flow, activities and interactions, and any challenges observed. A week after the class presentation of finished stories, the researcher conducted audio-recorded focus group interviews with the children. These were used to gain insight on the children's perspectives on the structured approach. Each stage of the implementation was discussed, including what children found most/least enjoyable, what

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they found easiest/most challenging and what, if anything, they felt they learned from the project.

Approach to Data Analysis

All of the data collected was coded using a repeated coding process to reduce and interpret the results. A spreadsheet containing a matrix of codes and their sources was developed, and the codes from each source were compared and combined to further reduce them.

Ethical Considerations

Prior to conducting this study, it was submitted for the approval of the DIT Ethics Committee. Permission to conduct the study with the participant school was secured through the school principal. The researcher and the class teacher jointly introduced the project to the class. Informed parental consent and child assent forms were distributed to each child. Consent forms granting permission for children to participate were returned for 27 out of the 28 children in the class. The child for whom an informed consent form was not returned participated in the class project, but no data was collected regarding their participation, and the child did not participate in focus group interviews. On the day of the focus group interviews, all children were given the option to opt out of the interviews. One child withdrew, and 25 children participated in the interviews. All data collected was anonymized and stored securely.

Findings and Discussion

This study was focused on the implementation of digital storytelling with young children in the Irish primary classroom context. Therefore, data analysis focused on findings that illustrated the effectiveness of the implementation approach with this cohort and indications

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of any improvements that could be made. The findings can be discussed with reference to Banaszewski's (2005) stages of implementation for digital storytelling: logistics and planning, story scripting, teaching elements of effective digital storytelling, managing the technology, and assessment. The children's stories were not assessed in this study, however, and so Banaszewski's assessment stage is not included in this discussion.

Logistics and Planning

Data from the interviews, researcher observations and the teacher's reflections were analyzed and compared to form a picture of key findings on logistics and planning. Managing logistical elements was found to be one of the biggest challenges in this study. Aspects such as one teacher supporting a large class of children working on computers at different paces, and establishing a quiet place and time for recording narration, presented particular challenges. Logistical management aspects are particularly significant in the Irish context, where over 20% of children are in classes of 30 or more (Department of Education and Skills, 2012), underscoring Banaszewski's (2005) recommendation that a helper be recruited for digital storytelling with children.

The study found that orientation of the teacher was a significant component of the planning stage. The teacher said that she felt well prepared for the implementation, but that before the class project began she was concerned that it may be daunting both for her and for the children. She indicated, however, that in reality her concerns did not materialize, they overcame issues that arose, and the experience was a very good one (Mar 12, 2013, rec.2t, 0:37). She felt the detailed lesson planning was important in making her comfortable with the process. The teacher in turn described each step in the approach explicitly to the children, explaining what was expected of them in each lesson. The teacher believed that the children's

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clear understanding of the process was a significant success factor (March 6, 2013 rec.2t, 13:15).

The results highlighted the importance of the teacher creating their own digital story. Following the orientation phase, the teacher created a simple digital story, and showed it to the children as a model in the first lesson. Both the teacher and the researcher agreed that this was a valuable step, as it was exciting for the children to see what could be done and gave them confidence to get started. This is in line with Banaszewski's (2005) assertion of the importance of the teacher creating their own digital story.

The findings also highlighted the importance of being clear about the purpose of a classroom-based digital storytelling project, corroborating Banaszewski's (2005) view on clarity of purpose. As a first experience of digital storytelling for the participants, it was decided that this implementation would emphasize the literacy skill of developing an effective story, rather than a content-based focus. The teacher's comments suggested that the focus on a story-centered approach to literacy development gave her a clear sense of purpose, and, for the children, a sense of ownership. In the teacher's words: "I realized this is really about literacy, it is really about storytelling, … the technology kind of looked after itself a bit in the end … because they were really still invested …because they loved the story that they had come up with" (March 12, 2013, rec.2t, 1:21). It was found too that the freedom of choice the implementation approach offered, allowing the children to choose and build their own story ideas, was significant, as suggested in children's responses on what they liked best about the project, for example:

> *that it was your own style that you could come up with and you could make it all your own* (March 6, 2013, rec.1fg, 3:57)

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> *I liked the way that you could choose your ideas and then build your own story*
> *out of all the group's ideas and then you make it your own story*
> (March 6, 2013, rec.3fg, 1:00).

It was also found that clarity around the level of technical skills involved is important in establishing the aims of the project. Data from observations and interviews suggested that tasks such as downloading images on different browsers and in different file formats presented challenges for some children. The teacher felt that perhaps an advance 'dry run' of the technology with a small group of children may have helped tease out technical issues. This supports Banaszewski's (2005) recommendation of pre-assessing the student's level of technical skills, following which the focus and goals of the project can be tailored accordingly.

In terms of lesson planning, interview data from both teacher and focus group interviews indicated that starting with the technology lesson was effective. It appeared to give the children confidence about what they could do, and many children suggested that they enjoyed the opportunity to try things out with the tool (Mar 6, 2013, rec.1fg, rec.3fg, rec.4fg). Findings on other aspects of lesson structure are discussed later.

Story Scripting

It was found that the time the teacher spent discussing critical elements of a story with the children, and exploring examples of familiar stories, was an important step. The teacher believed this step helped the children's understanding as they began to develop their stories (Mar 12, 2013, rec2t, 9:15), and reflects Behmer's (2005) view of how students need to recognize and understand story elements in order to write their own effective stories. The teacher perceived that Ohler's Visual Portrait of a Story (VPS) approach worked well for

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some children, while others connected more readily to a discussion of story structure based on a familiar story.

The findings also suggested that the scripting process was not a discrete stage, as Ohler's (2008) approach suggests, but more an evolving process that continued throughout the implementation, and one that echoed challenges identified by Banaszewski (2005) in the writing process. It was evident that the process of first writing a story script and subsequently developing the storyboard worked better for some children than others. Some groups' scripts were too long, others too short. It could be argued that the 10-slide storyboard template provided by the researcher might prompt children to think about economy. However, observation suggested that the children seemed to understand this to varying degrees. Some seemed to see storyboarding as more of a general planning tool, and it was evident that many stories continued to evolve significantly beyond the storyboarding phase and well into production, where seeing their stories on screen sometimes seemed to prompt children to recognize missing elements or ways to improve their stories (February 2013, Observation notes, p.5).

Peer review was found to play a significant role. The teacher believed the peer assessment was helpful to the process, although she noted that some children needed additional guidance on constructive criticism (March 12, 2013, rec.2t, 13:40), for which she suggested the 'two stars and a wish' approach. Feedback from the children further highlighted the impact of peer reviews. While a small number of children suggested that peer feedback was not helpful, it was evident that many groups had made significant changes to their stories as a result of peer feedback:

> *We were going the wrong way with it … if we didn't have that it would have been all wrong* (March 6, 2013, rec.3fg, 5:57)

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> *Our story wasn't really that good, and they helped us improve on it*
> March 6, 2013, rec.4fg, 6:10)

Having the children work in groups differs from the more typical individual personal narrative-based approach to digital storytelling, but this emerged as a benefit in several respects, including scripting. While the impact of group-work is beyond the scope of this study, it was interesting that most groups maintained that they had merged all the group members' individual ideas to come up with their final story, and some suggested that their combined ideas had created a better story. As one child said: "Our stories were good at the start, but I think when we all mushed them together, they were a lot better" (March 5, 2013, rec.2fg, 19:51).

The findings also indicated that the children came to appreciate a viewpoint emphasized widely by digital storytelling practitioners: the significance of the story and its structure. While one child admitted that the hardest thing about the project was "getting the story" (March 5, 2013, rec.4fg, 17:24), another said, when asked what they had learned from the project:

> *mostly it helped me to make a story, and how there's a story and a digital story*
> *…if the story isn't good … the effects or anything ain't going to make it better*
> (March 5, 2013, rec.1fg-b, 00:47).

Teaching Elements of Effective Digital Storytelling

Banaszewski (2005) suggests three skills domains to be addressed in teaching digital storytelling elements: the story domain - what makes a story a digital story, the visual/media domain - addressing visual literacy skills, and the technical domain - addressing the technical skills required to construct a digital story.

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The level of visual literacy emerged as an important finding. Visual literacy was explored at various points in the implementation, through initial discussion of sample digital stories, and as the children began to think about images and sounds that would enhance their own stories. As Ohler (2008) puts it, the emphasis was on helping children to "Tell a story that is strengthened rather than weakened by the media they use" (p.133). It was evident, however, that some children had difficulties with finding and choosing appropriate images for their stories. At least two groups, after struggling to find suitable images on the Internet, realized that it was better to draw their own illustrations. Another group realized their story would need several pictures of a single character in different situations, and that this would be difficult to find on the Internet. The teacher suggested that stories for which children created their own illustrations were some of the most effective and a future implementation might benefit from directing the children to use their own illustrations (March 12, 2013, rec.2t, 17:00). Evidence from the children also suggested that they found it hard to integrate all the media aspects they wanted, in the way they wanted, during the project timescale. Echoing literature recommendations for developing children's visual literacy skills (Banaszewski 2005; Ohler, 2008), these findings suggest that greater emphasis should be placed on activities to develop these important skills 21st century skills.

Looking at the story domain, it was evident that the children found the story time-limit a challenge (March 6, rec.1fg, 28:35; rec.4fg, 6:20), although the teacher felt that this limit helped them focus on the essence of the story (March 12, 2013, rec.2t. 30:37), and most completed stories were in the region of about two minutes. It was also evident that, despite challenges encountered in the development process, most groups were happy with their final stories.

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Managing the Technology

While some implications for technology aspects have been noted already, a few key findings emerged regarding the management of technology:

It was found that Windows Movie Maker 2.1 worked well as a production tool. Several children indicated that they found Movie Maker easy to use (March 6, 2013, rec.5fg, 3:10). This was reiterated by the teacher, who felt that its prescriptive nature was a benefit (March 12, 2013, rec.2t, 8:10). Some children commented on how they liked being able to see their story and its elements build on the timeline (March 6, 2013, rec.1fg, 23:10), suggesting that the literal view of story construction that the tool afforded was helpful.

The findings also indicated some challenges with the tool. The teacher noted that some children who did not know how to download images had difficulty getting started with Movie Maker (March 12, 2013, rec.2t, 7:31). Some pre-imported images and sounds might help such children get started. Importing pictures, recording narration, and saving their projects were repeatedly identified by children as difficult tasks (March 6, 2013, rec.1fg, rec.2fg, rec.6fg). These challenges reinforce findings noted earlier regarding the value of pre-assessing children's technical skills.

Hardware issues such as faulty microphones were also identified, a finding tallying with other research (Sadik, 2008; Robin, 2008). In this study such challenges at times slowed down progress and in some cases resulted in rework for children.

Finally, this study found that time was a significant challenge, echoing findings of Banaszewski (2005) and Dogan & Robin (2008). The initial estimate for the project was 10

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hours of class time, but the actual time spent was in the region of 12 hours. Most of the additional time was spend on production. While this suggests that it may be worth exploring ways to condense or simplify some of the tasks involved, it was also evident that children showed commitment and persistence with tasks such as revising their stories and rerecording audio until they were satisfied, and overcoming technical difficulties (February 2013, Observation notes, p10; March 6, 2013, rec.6fg, 14:00; rec.5fg, 11:08).

Limitations and Directions for Further Research

While this study was limited to an initial investigation of this structured approach to digital storytelling with one cohort of children, its findings indicate that the approach has potential to be used successfully in the Irish primary school setting. Following refinement of the structured approach used in this initial implementation, it should be run again with another participant group. Further research might look at the possibility of a series of units on digital storytelling, taking a scaffolded approach to develop the wide range of skills and literacies that digital storytelling can support. Research should also be conducted to adapt and evaluate the approach for content-based curriculum areas. It would also be interesting to examine further the collaborative nature of the process and ways to extend it (Di Blas & Paulini, 2013), as well as to explore how the expanding range of storytelling apps for both PCs and mobile devices can potentially support the digital storytelling creation experience.

Conclusion

This study serves to highlight the potential of a structured approach to digital storytelling as a way to integrate technology meaningfully in primary classrooms. Although limited to one participant group, the findings suggest that the structured approach implemented here can serve as an effective practical approach for teachers working with younger children. The

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findings highlight that implementing digital storytelling requires a clear plan regarding the purposes of the project, careful planning for logistical and technical considerations, and thoughtful orientation for the teacher on the many aspects of digital storytelling. Equipped with this approach, teachers can facilitate young children to engage effectively in the development of digital stories, offering teachers a rewarding teaching tool that supports a range of literacy skills, and can be used in a range of classroom projects to support the development of 21st century skills.

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