# *The effectiveness of digital storytelling in the classrooms: a comprehensive study*

Smeda et al. Smart Learning Environments (2014) 1:6
DOI 10.1186/s40561-014-0006-3

Smart Learning Environments
a SpringerOpen Journal

RESEARCH Open Access

# The effectiveness of digital storytelling in the classrooms: a comprehensive study

Najat Smeda[1*], Eva Dakich[2] and Nalin Sharda[1]

* Correspondence:
Najat.Smeda@live.vu.edu.au
[1]College of Engineering and Science, Victoria University, PO Box 14428, Melbourne 8001, Victoria, Australia
Full list of author information is available at the end of the article

## Abstract

In recent years the use of new technologies in educational systems has increased worldwide as digital cameras, personal computers, scanners, and easy-to-use software have become available to educators to harness the digital world. The impact of new technologies in educational contexts has been mostly positive as new technologies have given educators the opportunity to enhance their knowledge, skills, and therefore enhance the standard of education. Researchers have found that student engagement, achievement and motivation are enhanced through integration of such technologies. However, education systems still face many challenges: one of these challenges is how to enhance student engagement to provide better educational outcomes. It has become increasingly important to use innovative pedagogical models to engage learners. Digital storytelling is one of the innovative pedagogical approaches that can engage students in deep and meaningful learning. This research project aimed to create a constructivist learning environment with digital storytelling. The research investigated the pedagogical aspects of digital storytelling and the impact of digital storytelling on student learning when teachers and students use digital stories.

A multi-site case study was conducted in one Australian school at primary and secondary levels. In selected classrooms, students and teachers had the opportunity to engage in innovative learning experiences based on digital storytelling. In order to enhance the reliability and validity of the research, multiple methods of data collection and analysis were used. Data was collected with qualitative and quantitative methods. An evaluation rubric was used to collect quantitative data, while interviews and observation were used to collect qualitative data. Data collection was guided by a mixed methods research design in order to evaluate if and how digital storytelling enhances teaching and learning outcomes.

The findings from this study suggest that digital storytelling is a powerful tool to integrate instructional messages with learning activities to create more engaging and exciting learning environments. It is a meaningful approach for creating a constructivist learning environment based on novel principles of teaching and learning. Thus, this approach has the potential to enhance student engagement and provide better educational outcomes for learners.

**Keywords:** Digital storytelling; e-Learning; Multimedia; Student engagement; Student-centered learning; Constructivist learning

## Introduction

From ancient times to the present, storytelling has served as a popular education tool, utilised to pass knowledge from one generation to another. Over the past few years

drastic changes have been experienced in the processes used for creating stories, the variety of media used to convey the message, and the target audience. Storytelling, in general, is a powerful pedagogical approach that can be used to enhance learning outcomes for general, scientific and technical education (Sharda 2007). Stories have been told as a way of passing on traditions, heritage and history to future generations. Even today people continue to tell stories through new digital media tools. A digital story can be viewed as a merger between traditional storytelling and the use of multimedia technology (Normann 2011). Technological advances, such as digital cameras, editing software and authoring tools, have increased the use of technology in the classroom to help students in constructing their own knowledge and ideas to present and share them more effectively (Standley 2003).

As confirmed by Armstrong , computers, digital cameras, editing software, and other technologies are becoming more readily accessible in the classrooms, and provide learners and teachers with the tools to create digital stories more easily than ever before (Armstrong 2003). Furthermore, digital storytelling helps students to develop their creativity to solve important problems in innovative ways (Ohler 2008). It is an effective pedagogical tool that enhances learners' motivation, and provides learners with a learning environment conducive for story construction through collaboration, reflection and interpersonal communication. Students can use multimedia software tools as well as other technology skills to create digital stories based on given educational issues.

Digital storytelling is used as an embodiment of multimedia production for education purposes. Therefore, this is becoming a part of our lives, and is on the threshold of becoming an important part of teaching and learning as well. All of this is being facilitated by ready access to hardware, such as digital cameras and scanners, in conjunction with easy to use software. Many educational institutions have already been exploring the application of digital storytelling for the past few years (Robin 2008).

The power of storytelling as a pedagogical tool has been recognised since the beginning of humanity, and in more recent times, for e-Learning (Neal 2001). Digital storytelling has become a modern incarnation of the traditional art of oral storytelling; it allows almost anyone to use off-the-shelf hardware and software to weave personal stories with the help of still/moving images, music, and sound, combined with the author's creativity and innovation.

This research project aimed to explore the impact of digital storytelling on student engagement and learning outcomes. It focuses on exploring the potential of digital storytelling as an innovative teaching and learning approach, and investigates the impact of digital storytelling on student learning. The research involved a case study of an Australian P-12 school. It explored the use of digital storytelling within the primary and secondary curriculum. In selected classrooms students and teachers had the opportunity to engage in innovative learning experiences based on digital storytelling.

The outcomes of this research project aim to help teachers and learners tap into the power of digital storytelling and partake in more engaged teaching and learning.

## Background and literature review

In recent years, our lives have become more involved with technological tools. Developing technology resulted in new generations being more technology savvy than their

parents and, even more so, their grandparents. Consequently, researchers have argued that "the impact of the digital technologies and especially the Internet in the 21st century post-secondary classroom is unquestionable and dramatic" (Tamim et al. 2011).

According to Prensky, today's students are the first generation to grow up surrounded by digital technology (Prensky 2001). During their daily lives these students have been routinely exposed to computers, electronic games, digital music players, video cameras and mobile phones. They are immersed in instant messaging, emails, web browsing, blogs, wiki tools, portable music, social networking and video sites (Prensky 2001; Lea & Jones 2011; Sternberg et al. 2007). These technologies allow them to communicate instantly and access any information from virtually any place by pushing a few buttons (Autry & Berge 2011).

It is likely that the rise of some changes in educational practice, such as distance education, online learning and blended learning, has been the response to the integration of computers and the Internet to the new generation's lives (Tamim et al. 2011). Today's school environment includes technology, and teachers use it on a daily basis; the basic school infrastructure includes computers, printers, scanners, digital cameras and the Internet, and the majority of teachers have access to word processing, calculations, multimedia and communication software (Hsu 2013). According to Pitler, "Applied effectively technology not only increases students' learning, understanding, and achievement, but also augments their motivation to learn, encourages collaborative learning, and develops critical thinking and problem-solving strategies" (Pitler 2006). Therefore, attention should be given to the subject of technology integration (Sadik 2008).

### Storytelling

Throughout the history of human and social development, storytelling has been used as a tool for the transmission and sharing of knowledge and values, because it is a natural and yet powerful technique to communicate and exchange knowledge and experiences. Its application in the classroom is also not new; and in relation to the use of storytelling in the classroom Behmer stated, "Storytelling is a process where students personalise what they learn and construct their own meaning and knowledge from the stories they hear and tell" (Behmer 2005).

Over the last two decades, however, much has changed in how stories can be planned and created; and, as a result, how multimedia can be used to facilitate the dissemination of stories. With the increased use of computers to tell stories, by using a variety of hardware and software systems, there has been a significant improvement in the way stories can be created and presented (Van Gils 2005). According to Normann, "People have always told stories. It has been part of our tradition and heritage since the time we gathered around the fire to share our stories. Today people still tell stories, but now we have new media tools with which to share them. A digital story can hence be seen as a merger between the old storytelling tradition and the use of new technology" (Normann 2011). To some extent, traditional storytelling and the application of computer technology in education have followed different paths to date (Banaszewski 2005). Thus, there is a need to further increase the convergence of storytelling and the use of computers in the classroom. It has been argued that technology is more useful when it is used as part of a broader educational improvement agenda (Pitler 2006).

Fortuitously, with the increase in computer power and associated cost reduction, computers and related technologies can play a significant role in making storytelling a more widely used pedagogical tool, given that "Digital storytelling provides students with a strong foundation in what are being called '21st Century Skills'" (Miller 2009). While the essential technology is currently accessible in the classroom, storytelling has not been fully recognised as a valuable tool for developing students' learning skills and achieving 21st century learning outcomes.

## Digital storytelling

Digital storytelling emerged at the Center for Digital Storytelling in California in the late 1980s as a method employed by community theatre workers to enable the recording, production, and dissemination of stories (Lambert 2009). Normann defines digital storytelling as "a short story, only 2–3 minutes long, where the storyteller uses his own voice to tell his own story. The personal element is emphasised, and can be linked to other people, a place, an interest or to anything that will give the story a personal touch" (Normann 2011). This has developed in a number of ways, shaped by advances in personal computing and recording technology, and by its use in a range of academic and non-academic contexts (Normann 2011; Clarke & Adam 2012).

Digital storytelling is defined by The Digital Storytelling Association, as a "modern expression of the ancient art of storytelling" (The Digital Storytelling Association 2011). Although there is not a single digital storytelling definition, the majority emphasise the use of multimedia tools including graphics, audio, video, and animation to tell a story. Benmayor's digital storytelling definition is: "a short multimedia story that combines voice, image, and music" (Benmayor 2008). According to Kajder, Bull & Albaugh, a group of still images, combined with a narrated soundtrack, constitutes a digital story as long as they relate a story. Focusing on its presentation on screen, Alan Davis offers another definition of digital story as "a form of short narrative, usually a personal narrative told in the first person, presented as a short movie for display on a television or computer monitor or projected onto a screen" (Kajder et al. 2005).

Meadows offers a more technology-focused definition, where digital storytelling makes use of low-cost digital cameras, non-linear authoring tools and computers to create short multimedia stories to accomplish social endeavours of storytelling. It is a technology application which takes advantage of user-contributed content and assists teachers in utilising technology in their classrooms (Meadows 2003).

## Digital storytelling: a constructivist approach to learning

In recent decades, various learning paradigms have been used to enhance teaching and learning practice; each one of these learning theories, such as behaviourism, cognitivism and constructivism, has its own perspective on learning methods. Before explaining the main concepts underpinning each of these theories, first let us consider what a learning theory is. According to Hill, a learning theory is the attempt to explain how people (and animals) learn, and a paradigm to understand what is fundamentally involved in the learning process (Hill 2002).

The Behaviourism school founded by Thorndike, Pavlov and Skinner, was based on the assumption that learning changes behaviour, and resultant responses outside the

environment (Thorndike 1913; Pavlov 1927; Skinner 1974). Behaviour patterns include the use of direction signs and learning practice. A change in behaviour is based on corresponding changes in observable aspects of learning and the learning process. The key elements of behavioural patterns are motivation, answers, and the connection between them. One of the most important features is the incentive present for learning within a learning environment (Jung 2008).

Compared with behaviourism, which explores students' behaviour, cognitive theories inquire into the processes driving the behaviour. It places greater emphasis on the environment to facilitate the learning process (Jung 2008). Cognitivism focuses on the construction, organization and arrangement of educational content to facilitate optimal management of information, and how to remember, store, and retrieve information. In addition, learning is seen as a dynamic process, which is created by the learners themselves (Anderson 2008).

Constructivism is one of the most influential educational approaches developed in recent times. It overlaps the cognitive learning school in many ways; however, it is characterised by its emphasis on learning through the use of authentic contexts, and a focus on the importance of the social dimension of learning. Wilson defines it as "a place where learners may work together and support each other as they use a variety of tools and information resources in their guided pursuit of learning goals and problem-solving activities" (Wilson 1996).

In addition, according to Anderson the constructivist has more than a simple perspective on learning, recognising that people explain the learnt information and the world around them, based on their personal vision (Anderson 2008). Jonassen argues that learning environments should offer constructive, active, intentional, collaborative, complex, conversational, contextualised and reflective learning (Jonassen et al. 1999). To sum up, the most important learning characteristics of constructivism are that learners can build on their own interpretation of the world, depending on experience and interaction, and that will generate a new understanding through the collection of knowledge from various sources (Duffy et al. 2012).

On the other hand, the education theories developed in the 20th century consider teaching and learning as more than mere interaction or transmission of knowledge (Daniels 2001; Dewey 2007; Vygotsky et al. 1978; Wells 1999). These theories consider teaching as a specific paradigm of teacher–student interaction, where the desired role of the adult is a collaborator and/or co-constructor.

Bouman defines learning as the acquisition of knowledge or skills through experience, practice, or study, or by being taught. He classifies learning under different headings: the two main ones are student-led and teacher-led learning. Student-led learning is a process of learning information where students ask questions of one another, while they assist each other as peers in discussing the method used to acquire the answers to those questions; students are also allowed to work with one another in a student-centred environment. Teacher-led learning is currently the most popular form of teaching students. This method involves the teacher holding all the information and sharing it with the students over time. The most recent works in the literature favour student-led over teacher-led learning since it leads to longer retention. This hinges on the fact that when students take a more active role in their learning process, this results in a more meaningful connection to the information (Bouman 2012).

The learner's active position is strongly emphasised as it is indispensable for the development of lifelong learning skills (Verenikina 2008). The zone of proximal development (ZPD), developed by Vygotsky (Wells 1999), is defined as the distance between what a student can do with or without help (Vygotsky et al. 1978). The main focus in the ZPD is to ensure that students are actively engaged in learning that will make them self-directed, lifelong learners in the long run. In this sense, teaching becomes a co-construction of knowledge between learner and teacher. It also facilitates further transformation of that knowledge into individual student knowledge (Verenikina 2008; Dakich 2014).

Digital storytelling can thus facilitate a constructivist approach for teaching and learning. It can be a helpful educational tool, as it provides a vehicle for combining digital media with innovative teaching and learning practices. Apart from building on learners' technology skills, digital storytelling encourages additional educational outcomes (Dakich 2008). It enhances learners' motivation, and helps teachers in building constructivist learning environments that encourage creative problem solving based on collaboration and peer-to-peer communication. In addition, digital storytelling can be used to facilitate integrated approaches to curriculum development, and engage learners in higher order thinking and deep learning (Dakich 2008).

Consequently, as the literature review has revealed, digital storytelling is a powerful model for creating constructivist e-Learning environments. Digital storytelling has the potential to engage learners in integrated approaches to learning with digital media. Furthermore, digital storytelling enhances learners' motivation, and helps teachers in building constructivist learning environments. To facilitate the harnessing of these pedagogical benefits we need an overarching framework for creating digital stories. This framework should be cognisant of the needs and capabilities of learners at their various stages of learning (i.e. catering for learners from primary school to university level, and even professional e-Learning content creators).

This research presented a new e-Learning Digital Storytelling (eLDiSt) framework to be able to use digital storytelling as a pedagogical model for constructivist learning (Additional file 1: Appendix A). This framework was developed for application of digital storytelling at various stages of learning. The e-Learning Digital Storytelling (eLDiSt) framework also articulates how storytelling can be used at different levels of education. The eLDiSt framework is designed primarily as a tool to help story creators in producing engaging digital stories, the framework is based on thirteen storytelling aspects and five levels, and each aspect advances in complexity as the learner's level advances from level one to five. It considers the needs and abilities of learners at different stages of learning, including learners from primary school to university, and even professional e-Learning content creators. With the help of this eLDiSt framework, digital storytelling can be used as an efficient and effective learning tool at various levels of education. Different aspects identified in this framework enable teachers as well as students to fully grasp the elements required for an engaging and educative digital story.

Therefore, the mission of this research is to create a methodology for building constructivist learning environments based on digital storytelling, the outcomes of this research project aim to help teachers and learners tap into the power of digital storytelling and partake in more engaged teaching and learning.

## Methods

This research project investigated impact of digital storytelling on student engagement and outcomes. It focused on exploring the potential of digital storytelling as an innovative teaching and learning approach and its potential to enhance student engagement and student outcomes. This research involves a multi-site case study of an Australian P-12 school, and explores the use of digital storytelling within the primary and secondary curriculum. In the selected classrooms students and teachers had the opportunity to engage in innovative learning experiences based on digital storytelling. In order to enhance the reliability and validity of the research, both qualitative and quantitative methods of data collection and analysis were used. A rubric was used to collect quantitative data, while interviews and observation were used to collect qualitative data. Data collection and analysis of the feedback provided by teachers was based on mixed methods research to thoroughly evaluate the benefits of digital storytelling vis-à-vis teaching and learning.

### Research questions

The rationale for this project is to explore the pedagogical benefits of digital storytelling. Therefore, the overall research question is: How can digital storytelling enhance the student engagement and provide better educational outcomes for learners? This question can be divided into the following sub-questions:

- How can digital storytelling be used to enhance student engagement?
- How can digital storytelling be used to improve educational outcomes?
- What are teacher perceptions about student learning through digital storytelling?

### Significance of the study

Since the main aim of this research is to investigate the impact of digital storytelling on student learning, the outcomes of this research will enable both teachers and students to tap into the power of digital storytelling, leading to more engaged teaching and learning. This study contributes to new understandings of how to create authentic and constructivist learning contexts that can be used in a range of educational settings. The research focuses on how to implement digital storytelling in the classroom, describing the digital story workshop, and explaining teacher roles and student tasks; i.e. this research gives a clear picture of how to integrate digital storytelling into schools. Therefore, it is expected that the new knowledge generated by this research will inform educational policy and practice.

### Methodology

A case study design that uses multiple case studies was chosen for this research (Mello 2001). Case study research is a qualitative approach in which the researcher explores a case or multiple cases over time, involving multiple sources of information, for example, observations, interviews, documents and reports (Yin 2009; Creswell et al. 2007). The research methodology is designed to utilise both quantitative and qualitative methods. As previously mentioned, this research aims to explore the pedagogical benefits of digital storytelling; therefore, this research will focus on the level of the student

engagement and the associated educational outcomes using digital storytelling. In order to achieve a complete understanding of these phenomena, both quantitative and qualitative data were collected.

### Classroom observations

To record both qualitative and quantitative observations an observation tool was created (Additional file 1: Appendix B). This observation tool was adapted from WestEd (2002) to fit the purpose of this study. This tool contains three different forms:

- Pre-observation form (qualitative)
- Timed observation form (quantitative)
- Field notes form (qualitative)

The pre-observation and field notes forms were used to collect qualitative data. The pre-observation form was used to collect information about the class being observed, objectives of the story, and materials used. Whereas the field notes form was used immediately after the class, to write up research notes.

The timed observation form was used to collect quantitative data about the use of new technologies. The timed interval observation sheet is divided into several components, analysed for the percentage of time each variable observed in the classroom. To collect data, the observer checks the presence of various attributes of technology integration observed during three-minute intervals. The check marks for the noted intervals are then tallied for an overall distribution of observed events (Sadik 2008). This observation was conducted to examine the quality of student engagement in authentic learning tasks using digital storytelling, and specifically focuses on: class collaboration, knowledge gain, student roles, teacher roles, student engagement, technology integration and modes of learning.

### Evaluation rubric

In addition to classroom observations, a scoring rubric was used by teachers to assess the quality of the digital stories created by the students. This stage had two different aims: to assess the level of student engagement, and document the educational outcomes achieved through digital storytelling. The level of engagement is a quantity that can be measured with the help of a scoring rubric. According to Sadik, it is appropriate to use an assessment instrument, such as a scoring rubric, to evaluate ICT-based learning projects (Sadik 2008). Therefore, the role of digital storytelling was assessed by means of an evaluation rubric. An evaluation rubric created by the University of Houston (2011) was chosen as a guide to create the rubric for this research (Additional file 1: Appendix C). The evaluation rubric included nine criteria; these are: Purpose, Plot, Pacing of Narrative, Dramatic Question, Story Content, Grammar and Language Usage, Technological Competence, Emotional Content and Economy of Content. Four levels of descriptors were given for each category, with scores of 4, 3, 2, or 1 possible, depending on the level of success in that area.

### Teacher interviews

Once the level of engagement was measured, we needed to ascertain the educational outcomes associated with digital storytelling. To perform this step qualitative data was

collected through teacher interviews. After conducting interviews, the interview data were analysed to identify the benefits related to the use of digital storytelling as a pedagogical approach, and the teacher's opinion about integrating new technologies in their curricula and classroom.

Therefore, three different methods were utilised for data collection: observation, teacher evaluation rubric, and interview. Timed observation and field notes were used as the observation method, while a scoring rubric instrument was used for teacher assessment. Finally, an interview protocol was used for interviewing the participating teachers. The overall conclusions will be extracted by integrating the findings of each method (Creswell 2008).

#### *Participant groups*

This study involved five teachers from prioritised curriculum areas (Science, Art, English, Library and Social Studies) to integrate digital storytelling into the primary and secondary school curriculum during third and fourth terms in 2012.

Table 1 lists the details of each setting including the subject area in which the digital storytelling was implemented, the number of students, and days spent observing the project development, including viewing the digital story.

#### *Implementation of digital storytelling in classrooms*

Since the main aim of this research was to investigate the impact of digital storytelling on student learning when teachers and students use digital stories, and evaluate if and how digital storytelling could enhance student engagement and improve educational outcomes; the next section will focus on how digital storytelling is implemented in the classroom, describing the digital story workshop, and explaining the teachers' roles and students' tasks (Smeda et al. 2012).

As mentioned by Sadik, the use of technology is only effective if the teachers have the expertise to customise the use of technology for story creation. The benefits can only be received if teachers have the ability to use it in the classroom effectively (Sadik 2008). Therefore, the researcher started by giving an orientation seminar, followed by workshops to teachers during the first two weeks to support and engage them in the project.

The following steps were used to help teachers easily integrate digital storytelling in their classroom. It is not the only way to implement digital storytelling; however, it can provide clear strategies on how to integrate digital storytelling when teachers and their students do not have any previous training in digital storytelling (Ohler 2008; Sadik 2008; Miller 2009; Kajder et al. 2005; University of Houston 2011; Smeda et al. 2012; Robin 2006; Sharda 2005; Lasica 2006).

**Table 1 Case study groups**

| Cases | Grades | Subjects | Student numbers | Groups | Observation days |
|---|---|---|---|---|---|
| 1 | ESL* | English | 8 | Individual | 17 |
| 2 | 3-4 | Library | 92 | Groups of 4 to 5 students | 12 |
| 3 | 7 | Arts | 29 | Groups of 4 to 5 students | 12 |
| 4 | 9 | Sciences | 17 | Groups of 4 to 5 students | 7 |
| 5 | 11 | Improve personal skills | 4 | Pairs of students | 12 |

*English as Second Language.

#### *Teachers' workshop*

Two workshops were conducted for the teachers with the following main objectives:

1. Introduce Digital Storytelling (Workshop 1):
   - Objective: Describe the concept of digital storytelling
   - Facilitator: Researcher
   - Description: The workshop started with a conversation about teachers' experiences with digital sound, video, and storytelling. An overview of possible strategies for using digital storytelling as a medium for engaging students and improving learning outcomes. The potential power of digital storytelling as a teaching and learning tool was then explored within the constructivist paradigm.
2. Introduce Moviemaker software (Workshop 2):
   - Objective: Describe how to create a digital story with the Moviemaker software
   - Facilitator: Researcher
   - Description: In this workshop Moviemaker software was introduced to the teacher with an explanation of how to create a digital story using this software; various features and options available in Moviemaker were demonstrated.

#### *Students and teacher roles*

Students at different levels have different skills and knowledge, so they need different levels of help. For example, primary school students who have basic skills and knowledge need more direction and guidance to create a digital story. Obviously, students in different grades might need different levels of assistance and scaffolding. Therefore, students worked under the supervision of their teachers, and depending on each individual student, teachers provided help in constructing and creating the story. It is expected that the level of teacher support and the extent of scaffolding may vary across levels; teachers were prepared to provide this support through a series workshops (Smeda et al. 2012).

Using the following lessons, teacher and student worked together to create the digital stories step-by-step:

#### *Lesson 1: brainstorm*

The objective of this lesson is to brainstorm the story. Typical expected duration is 1 to 3 days. In this lesson, teachers divide students into groups and allocate topics for them to discuss between themselves, share their ideas with each other and brainstorm the story in different ways. The students jot down ideas and write the initial narrative for the story for a particular topic the teacher had given them.

#### *Lesson 2: storyboard*

The purpose of this lesson is to create the storyboard. The estimated duration is 2 to 4 days. In this lesson, teachers help their students in writing the storyboard to organise the story sequences. They also help students clarify the main ideas of the story. Students, on the other hand, create the storyboard and select the right element(s) for it. They may also start by writing a draft of their storyboard. This assists in planning the visual materials in the right order, and thinking about how to match images or videos with the voiceover and music.

#### *Lesson 3: search the material*

This lesson is directed towards collecting the material required to create the digital story over a period of 2 to 4 days. Teachers demonstrate to their students how to look for images from different sources such as books, magazines, and the internet. They also explain copyright and digital rights issues related to the materials used. Furthermore, teachers show the students how to use the digital camera, if required. It is the students' responsibility to choose elements which match their digital story such as photos, videos, and music.

#### *Lesson 4: creating the digital story*

The objective is to use Moviemaker software for creating a digital story. Due to the amount of work associated, the duration of this lesson is 5 to 10 days, the longest among digital story creation steps. For teachers, this lesson is designed to help students create the digital story and explain how to import pictures and videos into the Moviemaker software. Moreover, teachers help the students who want to record their voices and use them within the story. The students created the digital story based on the storyboard by importing the elements to Moviemaker software and recording their voice to add to the narrative and test if it works effectively with the digital story. They can also add special effects and adjust the length of each visual element. This is achieved by choosing and adding some special effects, such as music and transitions, to make the story more attractive, adjusting the length of each visual element to make sure it matches the narration, and this is done over the entire digital story.

#### *Lesson 5: editing and feedback*

This lesson is aimed at editing and finalising the digital story, after the student has created its first version. The duration of this lesson is 1 to 3 days. In this lesson teachers provide some feedback to incorporate further improvements before the final draft of the digital story. Students revise and edit the drafts based on teachers' comments and feedback. Then they discuss the final drafts with the teacher and other students. The final form of the story is prepared based on these comments and feedback.

#### *Lesson 6: presentation and evaluation*

The final step of digital story creation is about presenting and evaluating the finalised digital stories over 1 or 2 days. Teachers attend the student presentation and evaluate them based on story elements, story creation and presentation. The sole responsibility of the students in this lesson is to present the digital story to teachers, classmates, and parents.

## Results and discussion

Individual case studies using mixed methods constitute the body of this research. Data for this study was collected through observations, the evaluation rubric, and teacher interviews. Five separate case reports were prepared. The case reports aim to answer the research questions; and a cross-case matrix was developed for each research question. The intent of the study was not comparative, due to the fact that it was conducted in a single school and all five practice case studies were conducted at different educational levels such as Years 3–4 in primary school, and Year 11 in secondary school. In addition, the approach assumed in the implementation of this research was dependent

on teachers. Therefore, in one-class students worked autonomously, while in others they worked in groups.

Considering all the above parameters, the main focus of the research was not to perform a comparative analysis, but rather to evaluate the effects of digital storytelling on education. The intent was to capture the benefits of using digital storytelling to explore student engagement and outcomes, as well as teacher experience with digital storytelling.

Therefore, in this section will focus on the main conclusion derived from the discussion of main findings related to student's engagements and learning outcomes, as well as the teacher perceptions about digital storytelling as a pedagogical tool.

### Enhancing engagement

The findings of this research indicate that levels of student engagement fluctuate between moderate and high. In other words, students were always engaged in the classroom. The use of software and conducting searches for digital media took these levels to very high, and were the highest for student presentations. In all cases students liked using technology, searching the internet, and watching other digital stories. There were some differences in implementation. For instance, Year 7 students had very low engagement levels when they had to complete their storyboards. Year 9 students had a constant, high level of engagement as they occasionally presented their completed works. Some Year 11 students' lack of interest in school curriculum presented as an engagement problem. However, the use of digital media managed to increase their engagement level. This finding is supported by Dupain and Maguire who argued that educators continuously need methods to engage students' interest with teaching material. With the aid of the latest developments in technology, classrooms welcome digital storytelling as a means of teaching, and students are motivated to conceive an academic concept and transmit their own (Dupain & Maguire 2005).

The above findings are also in agreement with the current literature which encourages this new teaching approach, that is, digital storytelling permits students to utilise technology in an effective manner. Provision of appropriate resources and editing tools paves the way for student motivation and maximises its positive effect (Sadik 2008; Morris 2011). This encourages students to put more effort into their stories and to create quality products.

Yet another result confirming the above findings is reported by Gils, this research showed that pupils are more engaged with the practical environment. Digital storytelling makes practice and training more engaging, diverse, and customised to their needs and challenges, which makes it more realistic. In this sense, it encourages students to focus on using English to communicate with classmates. Digital storytelling has the advantage of engaging three different senses: hands, eyes and ears. It also increases students' technical literacy (Van Gils 2005).

On the other hand, the findings of this research indicate students had a hard time getting engaged in the class when they had to finish their storyboard; some students were not interested in any school activity including digital storytelling. Therefore, they had a low engagement level. However, when these students started recording their own videos, engagement levels increased significantly.

Consequently, it is possible to use digital storytelling to integrate instructional messages with learning activities to create more engaging and exciting learning environments. This teaching approach enhances emotional interest and cognitive attention, and reflects consistent and reliable transfer of knowledge in line with modern learning theories. Considering Barrett's findings, it can be concluded that digital storytelling combines student engagement and effective integration of technology into instruction, which are student-centred learning strategies (Barrett 2006).

### Fostering collaboration

The findings of this research indicated that students work collaboratively and engage with digital content. They did more work while directly using applications and digital resources, such as the internet and/or libraries, instead of conventional printed media, such as books. This research also observed collaboration between groups where different groups helped each other with technical or grammar issues. This increased their levels of communication.

The above findings are in agreement with Standley who found that the creation of digital stories encourages collaboration between students, which in turn leads to the utilisation of various cognitive capabilities. Moreover, when working in a group, individuals pay more attention to content (Standley 2003).

In addition, other researchers have found similar findings to those in this research. According to them, the digital learning experience can promote collaborative studying and encourages students to share resources online. Students' skills are also enhanced by using databases and internet sources. Furthermore, digital content ensures that different groups are helping each other, as networked digital content connects the whole class; students who participate in digital storytelling projects have better communication, organisational skills, and more confidence in terms of asking questions and expressing opinions (Robin 2006; VanderArk and Schneider. 2012; Hung et al. 2012).

The fact that students helped one another in problem solution and concept development reinforces the idea that cooperation and collaboration levels are increased with digital storytelling, in other words students have a higher engagement level when they are working in groups to create a story.

In conclusion, this research demonstrates that digital storytelling can increase students' collaboration and communication skills.

### Transforming learning

This research affirms that digital storytelling is suitable for a constructive approach to learning; because students work on their own story after receiving basic instructions from the teacher. Students have their own individual approach based on their interactions and experiences and generate novel outputs by using different sources in their creation of the digital story. These findings are in line with those reported by other researchers, such as Garrard who observed that digital storytelling supports constructivist learning and concluded that digital storytelling is a good method of teaching with positive impacts (Garrard 2011).

In addition, the findings of research conducted by Normann concur with this research. He concluded that digital storytelling is a perfect way of learning new things

and to implement constructive approaches to education, he reported that the method of conducting lessons impacted the students' approach to learning activities (Normann 2011).

The constructivist approach has several perspectives on learning since it recognises that human beings use their own personal vision in explaining the acquired information (Duffy et al. 2012). This was supported by teachers in our study who concluded that digital storytelling permits students to learn by doing, and providing a flexible learning environment enables students to use their own ideas.

In addition, the findings of this research confirm that facilitating or scaffolding the learning process is the teacher's main role. At the beginning, tasks, software and digital storytelling are explained by the teacher, which requires a teacher-led mode. Following this step, students have the necessary knowledge from which to start working autonomously, with some teacher supported learning.

Robin, who has a similar outlook on digital storytelling, found that a story created by the teacher will help students to enhance their abilities. The teacher thus builds the framework for discussing storytelling topics and makes conceptual and/or abstract subjects more comprehensible. Building on experience and knowledge with teacher support, students create their own story using iMovie and/or Moviemaker. Thus students improve their skill set with teacher support in project development (Robin 2008).

This has significant congruence with Miller's findings, i.e. students imitate interactions with their teacher and use these interactions to help others, thus building their interpersonal skills and confidence (Miller 2009).

### Building digital literacy

This research indicates that the utilisation of digital storytelling in education increases skills. Teachers witnessed that digital storytelling via technology integration assisted students, and helped them overcome their problems. As supported by Ohler, who viewed digital storytelling as a concept supporting creativity, students could solve crucial problems in unprecedented ways. Furthermore, teachers viewed digital storytelling as a valuable tool to increase research skills. A myriad of skills, such as spelling, writing, teamwork or collaborating with students and teachers, can be improved. Needless to say, the uptake of technology improves technical skills (Ohler 2008). Sadik arrived at a different conclusion in his research, where classroom observations and interviews showed that the use of technology is only effective if teachers have the expertise to customise content for story creation (Sadik 2008).

In addition, the findings of teacher interviews indicate that digital storytelling is an effective tool to help students improve their technical skills and information literacy. Students have the opportunity to choose the skill they want to work on and improve. This may include individual skills, such as spelling and writing, as well as interpersonal skills such as working in a team, or collaborating with students and teachers. Miller also found that in every class engaged in digital storytelling, one student acted like a tutor. This student not only worked on the project, but also provided technical support to peers in terms of developing their stories. In this sense, students are empowered to use their strongest skills, and improve them. Their research skills are also honed during video searches, scanning images and selecting audio content for the story (Miller 2009).

Also, the findings indicated that teachers believe that the use of stories in education is very beneficial for countries receiving immigrants, such as Australia, because a digital story incorporates multiple aspects of the curriculum, and all teachers should use this medium at some stage. One teacher commented that in their school, where they work with many students from non-English-speaking countries, students welcome the opportunity to express themselves through visual media, rather than more words; it facilitates communication for new students and builds their confidence. Similar finding were reported by Benmayor who stated that digital storytelling can help learners to transfer their knowledge, skills and culture, thereby evolving their thinking process and helping them gain confidence. Accordingly, digital storytelling can be classified as an asset based pedagogy (Benmayor 2008).

Additionally, the findings of teacher interviews indicated that, with digital storytelling, not only students but the teachers also got the opportunity to improve their technological skills. This included the use of electronic devices such as personal computers, cameras and recorders. Miller reported similar findings. She stated that digital storytelling is the best application for teachers to encourage students to increase their use and knowledge of technology and technical skills. Furthermore, in order to create these stories, not only the students but also the teachers are obliged to increase their technical proficiency in using personal computers, digital cameras, recorders, etc. This helped teachers keep up with the latest technology (Miller 2009).

### Personalising learning experience

The findings of this research show that digital storytelling can cater for greater diversity by personalising student's experience. It can help them improve their confidence, and contribute to enhanced social and psychological skills. It can also be used to support students with special needs such as ESL[a] and VCAL[b] students.

These findings are in line with other research outcomes reported in literature. Van Gils found that personalised education is one of the main advantages of digital storytelling. He argued that learners can present their experiences, reflections and evaluate their achievements while creating digital stories (Van Gils 2005). According to Ohler, digital storytelling helped students to become active participants rather than passive consumers of information (Ohler 2008).

Academic efforts that focus on the benefits of digital storytelling are supported by government agencies. Several governing and regulatory authorities have been working on improving the education system in terms of motivation, learning outcomes and professional integration. For instance, the Australian Curriculum in Victoria (AusVELS) was specifically designed to ensure that curriculum content and achievement standards established high expectations of all students (AusVELS 2013). According to AusVELS students are expected to enrich their learning experience, not only in a single aspect of the curriculum, but in all areas. It is known that students in Australian classrooms have varying needs based on individual's learning histories, abilities, cultural and educational backgrounds. In recognition of this fact, the Australian Curriculum Assessment and Reporting Authority (ACARA) is developing additional curriculum to promote learning outcomes for students with disabilities, and/or to assist students from different linguistic and learning backgrounds (ACARA 2013).

This fact is also recognised by the UNESCO program for the United Nations Decade of Education for Sustainable Development. It considers storytelling to be one of the modules which can be used to equip students with professional learning and teaching skills. This helps students achieve a wide range of knowledge, skills and values, which is the objective of Education for Sustainable Development (UNESCO 2010). The use of storytelling in Australian schools is bound to have a lasting impact, since it is defined by UNESCO as "a key teaching strategy for achieving the objectives of education for sustainable futures" (p.1).

Consequently, suffice to say that digital storytelling has, inter alia, the benefit of increasing student motivation, especially for those students who have difficulties with reading and writing, allowing personalisation of the learning experience, acquiring experience with in-depth and comprehensible reading and becoming more proficient at technical aspects of language. Digital storytelling can be used to develop personalised learning experiences for students, thereby responding to diverse individual needs.

### Impact of digital storytelling on student outcomes

As the latest report for the Programme for International Student Assessment (PISA) indicated that the use of technology in education can increase various skills of learners, the findings of this research also suggested that digital storytelling can enhance several learning skills including writing, designs, library and research, technology and communication.

In addition, digital storytelling can help students with tasks they previously found very difficult including spelling, sentence formation and building, and forming the whole body of a text; this integration of technology assisted students to overcome their writing problems.

However, age and ability to learn technological subjects have some impact on the outcomes. When compared with primary school students, secondary school students have the ability to learn more and faster. They use the internet and computers more than primary school students. This was apparent during the study, especially where primary school students worked exclusively on their stories in the class, secondary school students worked on their stories, both inside and outside the class.

Furthermore, teachers observed that students were learning without realising. Provided that students are clearly informed about the task that is required of them, digital storytelling is useful as an all-round skill development tool; the use of digital storytelling can therefore reinforce various complementary skills.

The findings of the cross-case analysis based on the rubric data are presented in the following sections.

### Overall mean level of student scores

Figure 1 shows the mean of overall scores received by students for digital story quality for all cases. The overall scores were very close, despite the differences in age, subject, knowledge, technology use, etc. Nevertheless, the students in primary school (i.e. ESL and Years 3/4), received the lowest scores while those in secondary school had much better results. There are two reasons for this. Firstly, primary school students did not have prior exposure to Moviemaker software while more secondary school students had used it before.

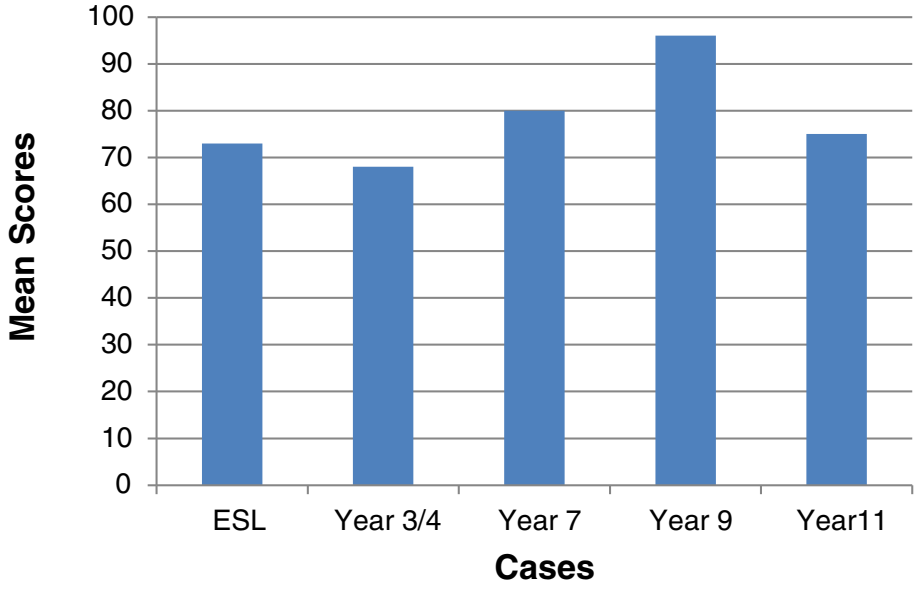


**Figure 1** Overall scores for digital story quality for the five case studies.

Furthermore, age and ability to learn technological subjects have sme impact. When compared with primary school students, secondary school students have the ability to learn faster and learn more. They use the internet and computer more regularly than primary school students. This was apparent during the study where the primary school students worked on their stories only in the class. On the other hand, secondary school students worked more regularly on their stories, both inside and outside the class.

It is observed that the subject does not impact student performance. However, the approach taken by the teacher proved to have significant impact. This was observed in two cases. In Years 3–4, the teacher observed that students were struggling with their writing and opted to introduce software so that the students had a clear idea about what was required of them. This additional step increased student performances.

In Year 7, the teacher asked the students to present their work when it was finished. Consequently, almost every fortnight there was a story presentation in class and this contributed to their engagement and better performance. Year 11, Victorian Certificate of Applied Learning (VCAL) students were a special case. There were two groups, one of which was working very well, while the other group was not interested in school work. Although digital storytelling created some interest in the second group, especially during video shoots and presentation, it was not easy to engage them with the overall task. They did not work on the story creation, required constant help from the teacher and received a very low mark.

### Overall performance based on evaluation criteria

Figure 2 shows the mean score obtained for the selected criteria for the five case studies. This shows that primary school students performed well in story aspects such as purpose, plot, pacing of narrative, dramatic question, story characters, and emotional content. This is because they planned their storyboard well. The key to their success

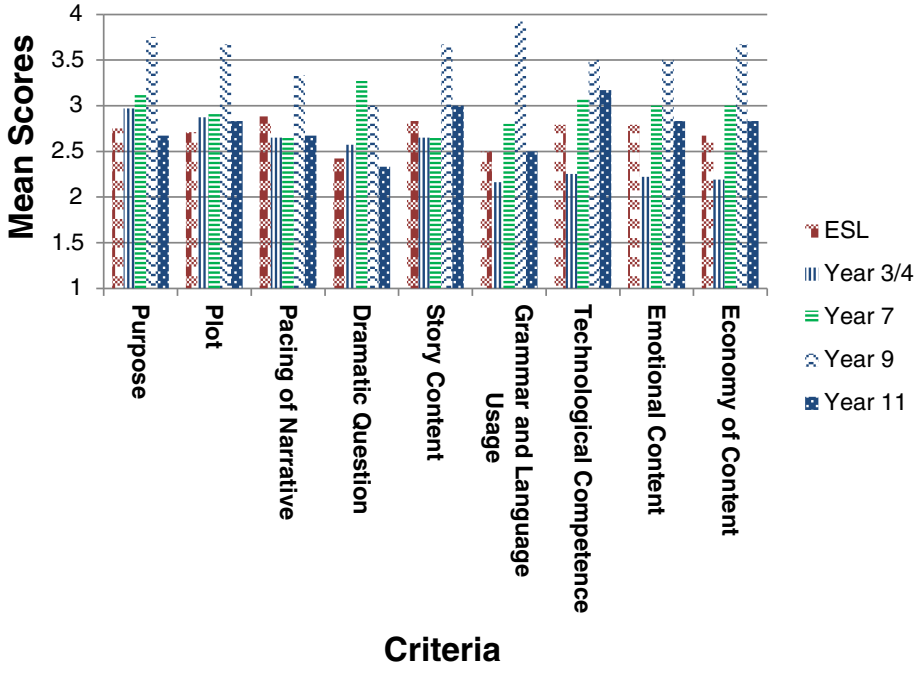


**Figure 2** Mean Score for criteria for the five case studies.

was that they spent more time in writing and editing their story with some help from the teacher, before actually starting the creation process. However, they did not perform as well in technological components, emotional content and economy of the story. Nor did they perform as well in the "Dramatic Question" and "Grammar and Language Usage" since their knowledge of English was limited.

On the other hand, secondary school students were a complete contrast. They performed not so well in the story aspects since they did not want to spend much time writing and storyboarding. This affected their scores in "Plot" and "Pacing of Narrative". Their competency in technology helped them receive high marks in technological components such as "Technological Competence", "Emotional Content" and "Economy of content". This can be traced back to their age group and knowledge in technology use.

### Teacher perceptions about student learning through digital storytelling

Teachers had a positive attitude towards the use of digital storytelling as a teaching tool in their classrooms, as both students and teachers had the opportunity to improve their technological skills, which included the use of various electronic devices, as previously mentioned.

Teachers indicated that digital storytelling increased and enhanced the use of technology in the classroom, which helped students improve their technical skills and information literacy; digital storytelling can also be applied to subjects such as English and History, and in almost all the sciences including mathematics, social studies and humanities.

Furthermore, teachers confirmed that the use of digital stories in education is beneficial for countries receiving immigrants, such as Australia. The ability for expression

through visual media, rather than words, facilitates communication for new students and builds their confidence. In addition, teachers fulfilled the role of facilitator, consultant, and could scaffold the learning process more effectively when they used digital storytelling in class.

## Conclusion

Since the main aim of this research was to investigate the impact of digital storytelling on student learning, the outcomes of this research will enable both teachers and students to tap into the power of digital storytelling and more engaged teaching and learning. This study contributes to new understandings of how to create authentic and constructivist learning contexts that can be used in a range of educational settings. The research focused on how to implement digital storytelling in the classroom, describing the digital story workshop, and explaining teacher roles and student tasks; therefore, this research gives a clear picture of how to integrate digital storytelling into schools. Consequently, the new knowledge generated by this research can inform future educational policy.

Furthermore, a number of story development models have been created in the past to help educators achieve better learning outcomes with digital storytelling; however, none of these models provide a holistic pedagogical framework for engaging students with digital storytelling during various stages of learning. This research presented a new e-Learning Digital Storytelling (eLDiSt) framework for using digital storytelling as a pedagogical model for constructivist learning.

In addition, even though the findings of this research are important and have the potential to inform policy, practice and theory, generalisations could not be derived due to the following reasons. The research only included participants from one school (even though there were two levels: primary and secondary) and limitations related to the participant sample used, since unequal numbers of students from primary and secondary schools took part in this research. In future research this limitation could be overcome by using multiple sites instead of one school, and the same participant sample, if possible. Another issue is related to the limited access to technology in the school; the students faced some technical problems while creating their digital stories, also there was some shortage of computers in the labs.

The results of this research indicate that digital storytelling can provide support to students with special needs, such as ESL and VCAL students. In addition, digital storytelling can help students to improve their confidence, and can contribute to better social and psychological skills.

## Endnotes

[a]English as Second Language.

[b]Victorian Certificate of Applied Learning.

## Additional files

**Additional file 1: Appendix A: The e-Learning Digital Storytelling (eLDiSt) Framework.** Appendix B: Classroom observation protocol. Appendix C: The scoring rubric instrument.

**Competing interests**
The authors declare that they have no competing interests.

**Authors' contributions**

NS is a lecturer at Al-Jabel Al-Gharbi University, Libya.Najat received her PhD from the College of Engineering and Science at Victoria University in Melbourne, Australia , her research project titled "Creating a Constructivist Learning Environment with Digital Storytelling". She received her Master's degree from University of Twente, Netherlands in technology applications in education and training. She finished her Bachelor's degree from University of Al-Jabel Al-Gharbi, Libya and she worked as an academic teaching member at University of Al-Jabel Al-Gharbi, Libya for more than 8 years. ED is a Senior Lecturer and Program Leader of Secondary Teacher Education at the Faculty of Education, La Trobe University in Melbourne, Australia. ED was a recipient of the Australian Postgraduate Award and has published widely about the pedagogical and social transformations occurring in the digital age. These included a co-edited book, book chapters, journal articles, monographs and refereed conference papers focusing on 21st century learning and digital inclusion. Eva worked as a researcher and consultant on large Australian research projects, such as the National Evaluation of The Smith Family's Tech Packs Project (2009-2010), as well as on the Evaluation of the Victorian Technology Enriched Curriculum Project, TECP (2011-2013), a Closing the Gap initiative. She is committed to transdisciplinary research and supervision of doctoral candidates, and works internationally with colleagues from a variety of scholarly disciplines. She is a member of several international associations promoting new learning and eCitizenship. NSh gained B.Tech. and Ph.D. degrees from the Indian Institute of Technology, Delhi. Presently he teaches and leads research in innovative applications of computer technologies at the College of Engineering and Science, Victoria University, Australia. NSh publications include the Multimedia Information Networking textbook, and around 120 papers and handbook chapters. Nalin has invented Movement Oriented Design (MOD) paradigm for the creation of effective multimedia content based experience, and applied it to e-Learning and other applications. NSh has led e-Tourism projects for the Australian Sustainable Tourism CRC, and is currently guiding research in the innovative applications of ICT systems to sustainable living. NSh has been invited to present lectures and seminars in the Distinguished Lecturer series of the European Union's Prolearn program, and by the IEEE Education Society. He has presented over fifty seminars, lectures, and Key Note addresses in Austria, Australia, Finland, Germany, Hong Kong, India, Malaysia, Pakistan, Japan, Singapore, Sweden, Switzerland, UAE, and USA. All authors read and approved the final manuscript.

**Acknowledgements**

We are grateful for the support we received from East Preston Islamic School; we would like to thank all the students and teachers who participate in this research. Also we would like to acknowledge the support and help provided by Prof. Neil Diamond and Dr. Ewa Sztendur for their statistical support in analysing the data.

**Author details**

[1]College of Engineering and Science, Victoria University, PO Box 14428, Melbourne 8001, Victoria, Australia. [2]Faculty of Education, La Trobe University, Melbourne Campus, Bundoora 3086, Victoria, Australia.

Received: 21 May 2014 Accepted: 10 October 2014
Published online: 03 December 2014

**References**

ACARA, *The Australian Curriculum*, 2013. 30/12/2013; Available from http://www.australiancurriculum.edu.au/

T Anderson, *The theory and practice of online learning* (Athabasca University Press, 2008)

S Armstrong, The power of storytelling in education, in *Snapshots*, ed. by S Armstrong. Snapshots! Educational insights from the Thornburg Centre, 2003, pp. 11–20

AusVELS, *The Australian Curriculum in Victoria*, 2013. 30/12/2013; Available from http://ausvels.vcaa.vic.edu.au/

AJ Autry, Z Berge, Digital natives and digital immigrants: getting to know each other. Ind Commercial Train **43**(7), 460–466 (2011)

T Banaszewski, *Digital storytelling: Supporting digital literacy in grades 4–12* (Citeseer, 2005)

H Barrett, Researching and evaluating digital storytelling as a deep learning tool. Soc Inf Technol Teacher Educ Int Conf **2006**(1), 647–654 (2006)

S Behmer, *Literature Review Digital storytelling: Examining the process with middle school students*, 2005

R Benmayor, Digital storytelling as a signature pedagogy for the new humanities. Arts Humanit High Educ **7**(2), 188–204 (2008)

K Bouman, *Retention of Learning: Student-led Classrooms or Traditional Classrooms?* (Southwest Minnesota State University, 2012)

R Clarke, A Adam, Digital storytelling in Australia Academic perspectives and reflections. Arts Humanit High Educ **11**(1–2), 157–176 (2012)

JW Creswell, WE Plano, V Clark, A Morales, Qualitative research designs selection and implementation. CounsPsychol **35**(2), 236–264 (2007)

JW Creswell, *Research design: Qualitative, quantitative, and mixed methods approaches* (Sage Publications, Incorporated, 2008)

E Dakich, Towards the social practice of digital pedagogies, in *Rethinking education with ICT: New directions for effective practices*, ed. by G.N.E.D. Yelland (Sense Publishers, 2008), pp. 13–30

E Dakich, "Theoretical and Epistemological Foundations of Integrating Digital Technologies in Education in the Second Half of the 20th Century", in *Reflections on the History of Computers in Education* (Springer Berlin Heidelberg, 2014), pp. 150–163

H Daniels, *Vygotsky and pedagogy* (Psychology Press, 2001)

J Dewey, *Experience and education* (Simon and Schuster, 2007)

TM Duffy, J Lowyck, DH Jonassen, *Designing environments for constructive learning* (Springer Publishing Company, Incorporated, 2012)

M Dupain, L Maguire, *Digital story book projects 101: How to create and implement digital storytelling into your curriculum*. Paper presented at the Proceedings of 21st Annual Conference on Distance Teaching and Learning, 2005

D Garrard, *A case study to evaluate the effectiveness of digital storytelling as a narrative writing tool*. Masters thesis (University of Limerick, 2011)

WF Hill, *Learning: A survey of psychological interpretation* (Allyn and Bacon, Boston, MA, 2002)
P-S Hsu, Examining changes of preservice teachers' beliefs about technology integration during student teaching. J Technol Teacher Educ **21**(1), (2013)
CM Hung, GJ Hwang, I Huang, A Project-based digital storytelling approach for improving students' learning motivation, problem-solving competence and learning achievement. Educ Technol Soc **15**(4), 368–379 (2012)
DH Jonassen, KL Peck, BG Wilson, *Learning with technology: a constructivist perspective* (Prentice Hall, Upper Saddle River, NJ, 1999)
EJ Jung, *Comparison of Major Learning Paradigms*. EDIT 6100 Introduction to Instructional Technology, 2008. 10/5/2014; Available from: http://81bada.myweb.uga.edu/portfolio/comparison.pdf
S Kajder, G Bull, S Albaugh, *Constructing digital stories, in learning & leading with technology*, 2005
J Lambert, *Where it all started: The center for digital storytelling in California*. Story circle: Digital storytelling around the world, 2009, pp. 79–90
JD Lasica, *Digital Storytelling: A Tutorial in 10 Easy Steps*, 2006. 10/5/2014; Available from: http://www.socialbrite.org/2010/07/15/digital-storytelling-a-tutorial-in-10-easy-steps/
MR Lea, S Jones, Digital literacies in higher education: exploring textual and technological practice. Stud High Educ **36**(4), 377-393 (2011)
D Meadows, Digital storytelling: research-based practice in new media. Vis Commun **2**(2), 189–193 (2003)
R Mello, The power of storytelling: how oral narrative influences children's relationships in classrooms. Int J Educ Arts **2**(1), 1–14 (2001)
E Miller, *Digital Storytelling, in Department of Curriculum and Instruction* (University of Northern Iowa, 2009)
RJ Morris, *Responses of listener-viewers in digital storytelling: Collaborations in the intermediate classroom and the middle school library*. PhD thesis (University of Pittsburgh, 2011)
L Neal, Storytelling at a distance. eLearn Mag **5**, 4 (2001)
A Normann, *Digital Storytelling in Second Language Learning, in Faculty of Social Sciences and Technology Management* (Norwegian University of Science and Technology, 2011), p. 125
J Ohler, *Digital storytelling in the classroom: New media pathways to literacy, learning, and creativity* (Corwin Pr, Thousand Oaks, CA, 2008)
IP Pavlov, *Conditioned reflexes*, 1927. DoverPublications. com
H Pitler, Viewing technology through three lenses. Principal-Arlington **85**(5), 38–42 (2006)
M Prensky, Digital natives, digital immigrants part 2: do they really think differently? On the Horizon **9**(6), 1–6 (2001)
B Robin, The educational uses of digital storytelling. Soc Inf Technol Teacher Educ Int Conf **2006**, 709–716 (2006)
BR Robin, Digital storytelling: a powerful technology tool for the 21st century classroom. Theory Into Pract **47**(3), 220–228 (2008)
A Sadik, Digital storytelling: a meaningful technology-integrated approach for engaged student learning. Educ Technol Res Dev **56**(4), 487–506 (2008)
N Sharda, Movement oriented design: a new paradigm for multimedia design. Int J Lateral Comput **1**(1), 7–14 (2005)
N Sharda, Applying movement oriented design to create educational stories. Int J Learn **13**(12), 177–184 (2007)
BF Skinner, *About behaviourism* (Jonathan Cape, London, 1974)
N Smeda, E Dakich, N Sharda, Digital Storytelling with Web 2.0 Tools for Collaborative Learning, in *Collaborative Learning*, 2012, pp. 145–163
M Standley, *Digital Storytelling: Using new technology and the power of stories to help our students learn-and teach*. Cable in the Classroom, 2003, pp. 16–18
BJ Sternberg, KA Kaplan, JE Borck, Enhancing adolescent literacy achievement through integration of technology in the classroom. Reading Res Q **42**(3), 416–420 (2007)
RM Tamim, G Lowerison, RF Schmid, RM Bernard, PC Abrami, A multi-year investigation of the relationship between pedagogy, computer use and course effectiveness in postsecondary education. J Comput High Educ **23**(1), 1–14 (2011)
The Digital Storytelling Association, *The center for digital storytelling*, 2011. 10/5/2014; Available from: http://electronicportfolios.com/digistory/
E Thorndike, *Educational Psychology: The Psychology of Learning* (Teachers College Press, New York, 1913)
UNESCO. *Teacher and Learning for a Sustainable Future*, 2010. 27/12/2013, Available from http://www.unesco.org/education/tlsf/mods/theme_d/mod21.html
University of Houston, *The educational uses of digital storytelling*, 2011. 10/5/2014; Available from: http://digitalstorytelling.coe.uh.edu/
F Van Gils, *Potential applications of digital storytelling in education. in the proceedings of 3rd Twente Student Conference on IT, Enschede June*, 2005
T VanderArk, C Schneider, How digital learning contributes to deeper learning. (2012). 30/12/2013; Available from http://net.educause.edu/ir/library/pdf/CSD6152a.pdf
I Verenikina, Scaffolding and learning: Its role in nurturing new learners, in *Learning and the learner: exploring learning for new times*, ed. by P in Kell, W Vialle, D Konza, G Vogl (University of Wollongong, 2008), p. 236
LS Vygotsky, *Mind In Society: The Development of Higher Psychological Processes* (Cambridge, MA: Harvard University Press,2008)
G Wells, *Dialogic inquiry: Towards a socio-cultural practice and theory of education* (Cambridge University Press, 1999)
WestEd, *Preparing tomorrow's teachers to use technology (PT3), Integration of Technology Observation Instrument grant*, 2002. Available from: http://www.west.asu.edu/pt3/assessment/observation.htm
BG Wilson, *Constructivist learning environments: Case studies in instructional design* (Educational Technology Publications, Englewood Cliffs NJ, 1996)
RK Yin, *Case study research: Design and methods*, 5th edn. (Sage Publications, Incorporated, 2009)