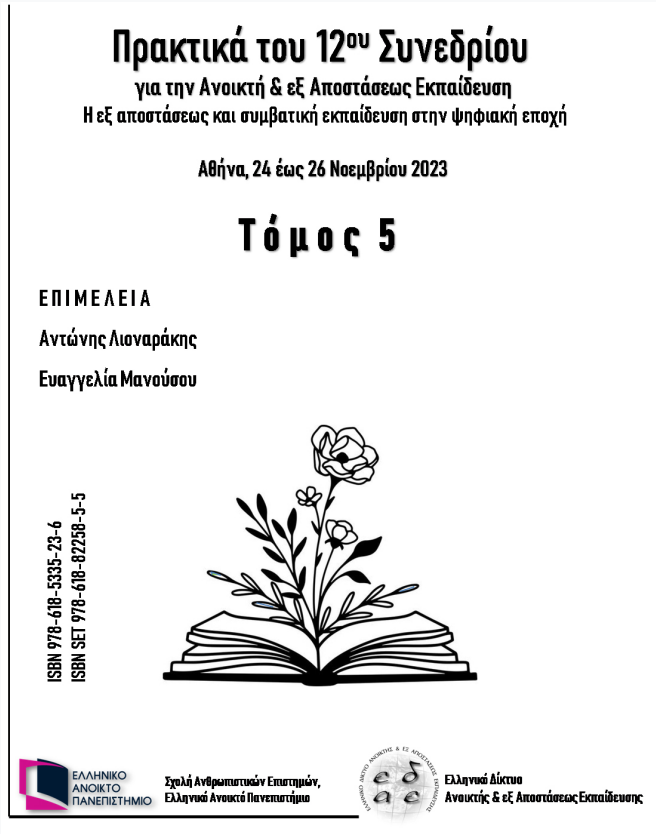
Διεθνές Συνέδριο για την Ανοικτή & εξ Αποστάσεως Εκπαίδευση

Τόμ. 12, Αρ. 5 (2023)

ICODL2023



Educational Digital Storytelling and Learning Theories

ΠΑΝΑΓΙΩΤΗΣ ΨΩΜΟΣ

doi: 10.12681/icodl.6014

Educational Digital Storytelling and Learning Theories

Εκπαιδευτική Ψηφιακή Αφήγηση και Θεωρίες Μάθησης

Ψώμος Παναγιώτης
Μέλος ΣΕΠ
Ελληνικό Ανοικτό Πανεπιστήμιο
ppsomos@gmail.com

Περίληψη

Βασικός σκοπός της εκπαίδευσης είναι η επίτευξη της μάθησης. Έχουν δοθεί πολλοί ορισμοί ως προς το τι είναι μάθηση με κοινό στοιχείο των περισσοτέρων πως μάθηση είναι η αποτύπωση των αλλαγών στη συμπεριφορά ενός ατόμου ως αποτέλεσμα της εμπειρίας (De Houwer, Barnes-Holmes & Moors, 2013). Μια θεωρία μάθησης έχει ως σκοπό να περιγράψει και να εξηγήσει πως μαθαίνουν οι άνθρωποι, συμπεριλαμβανομένων των μηχανισμών και των διαδικασιών που εμπλέκονται. Η εκπαιδευτική ψηφιακή αφήγηση είναι μια διδακτική στρατηγική που βασίζεται σε σύγχρονες θεωρίες μάθησης. Το επίκεντρο αυτού του άρθρου είναι η σχέση μεταξύ εκπαιδευτικών δραστηριοτήτων ψηφιακής αφήγησης και ορισμένων σημαντικών και αναγνωρισμένων σύγχρονων θεωριών μάθησης, συγκεκριμένα, (α) εποικοδομισμός, (β) κοινωνικός εποικοδομισμός, (γ) κονστρουκτιβισμός, (δ) αφηγηματική θεωρία, (ε) θεωρία γνώσης τεχνολογικού παιδαγωγικού περιεχομένου, (στ) η γνωστική θεωρία πολυμεσικής μάθησης, (ζ) ανακαλυπτική μάθηση και (η) ανδραγωγική θεωρία.

Λέξεις-κλειδιά

ψηφιακή αφήγηση, θεωρίες μάθησης, κονστρουκτιβισμός, κονστρουκτιβισμός, αφηγηματική θεωρία, TPCK, ανακαλυπτική μάθηση, ανδραγωγική

Abstract

A key purpose of education is to achieve learning since learning plays a key role in the development of human society. There are many definitions of what learning is,

with the common thread being that learning is capturing changes in an individual's behavior due to experience (De Houwer, Barnes-Holmes & Moors, 2013). A learning theory aims to describe how people learn, including the mechanisms and processes involved. Educational digital storytelling is a teaching strategy based on contemporary learning theories. The focus of this article is the relationship between educational digital storytelling activities and some important and recognized contemporary learning theories, namely: (a) constructivism, (b) social constructivism, (c) constructionism, (d) narrative theory, (e) technological pedagogical content knowledge theory, (f) cognitive theory of multimedia learning, (g) discovery learning, and (h) andragogy theory.

Keywords

digital storytelling, learning theories, constructivism, constructionism, narrative theory, TPCK, discovery learning, andragogy

Introduction

A learning theory provides a basis for explaining whether and to what extent learning occurs in a particular context, as well as the ability to predict what might happen if the conditions involved in the learning context change (Spector, 2016). An early example of learning theory can be drawn from the Platonic dialogues (Meno & Phaedo) where Plato argues that the soul is immortal and has existed in eternity. As a result, the soul knows everything. However, the birth of a human involves the traumatic process of placing the soul in a new body, which is so traumatic that the soul forgets what it has known through the ages. The process of knowledge, according to Plato, is the process of recalling all that the soul knew but forgot. So learning, according to the Platonic theory of learning, is the process of remembering what the soul has forgotten. Although Plato's theory is problematic in many respects, it presents the nature of a learning theory. First, it rests on a larger perspective, which in Plato's case is immortal souls. Second, it includes a description of what one can learn, which in Plato's case is immortal truths. Third, it includes a reference to the essential processes that result in learning, which for Plato is the

process of remembering. Finally, a learning theory has implications for teaching and education, which according to Plato is the teacher who reminds his students of things (Spector, 2016).

Important modern theories of learning were developed in the 20th century based primarily on the scientific method (via falsifiability/verification through experimentation). These theories are not individual theoretical models but are based on large currents of scientific thought (scientific paradigms). They are based on specific positions axiomatically formulated several times and then smaller interconnected theories emerge that explain in a complementary way the same or different aspects of the learning phenomenon and each one contributes to the formation of the wider stream of thought to which they belong (Dimitriadis, 2015). Educational digital storytelling is a teaching strategy based on contemporary learning theories. In this article, the connection that educational digital storytelling activities have with some important and recognized modern learning theories was studied. Specifically, the relationship of digital storytelling with: (a) constructivism, (b) social constructionism, (c) constructivism, (d) narrative theory, (e) the cognitive theory of multimedia learning, (f) theory of technological pedagogical content knowledge, (g) discovery learning and (h) andragogy theory.

Digital Storytelling and Constructivism

The theory of constructivism is based on the view that new knowledge is self-constructed by a learner when they have new experiences and try to integrate the novel information into their cognitive potential (Dimitriadis, 2015). According to constructivism, knowledge cannot be objective since it cannot be understood independently of the person whose construct it is. This construction acquires a subjective character since it is founded on a learner's prior mental patterns, determining how the new knowledge is utilized. According to the constructivist view, the reorganization of prior knowledge is precisely what is sought through the development of an individual's various cognitive structures, like schema and mental models, and is based on a learner’s prior knowledge and interests (Piaget, 1952). Considered the founder of constructivist learning theory, Piaget (1896-1980) focused on how people create meaning by interacting with their experiences and ideas. Thus,

he contributed to genetic epistemology, i.e., to the explanation of how knowledge is generated.

The emerging theory of digital storytelling as an educational tool seems to suit applying the constructivist approach to learning in practice (Feher, 2008) as it allows students to learn by doing. It also provides a flexible learning environment that allows students to use their own ideas (Smeda, Dakich & Sharda, 2013). Digital Storytelling can be used in a creative way not only in the classroom environment at school but in distance education as well (Karantalis & Koukopoulos, 2022). Constructivist learning is most clearly displayed in the process of creating a story, which, on many levels, is a process of meaningful learning (Alexander, 2011) that recognizes the relationship between education and experience. Constructivist learning argues that children's active participation in learning helps create their own meaning (Sweeney-Burt, 2014). According to constructivist learning theory, learning objectives should be clearly defined and should, as far as possible, come from learners themselves (Wilson & Myers, 2000). Digital storytelling lends itself to the constructivist approach to learning, as students create their own digital stories according to their individual approaches based on their personal interactions and experiences. They create original digital stories using different sources (Smeda, Dakich & Sharda, 2013). This process provides a lively and enjoyable mechanism for mapping the development of students' learning skills (Alexander, 2011). At the same time, digital storytelling helps educators build constructive learning environments that encourage creative problem-solving based on collaboration and peer communication (Smeda, Dakich & Sharda, 2013).

Digital Storytelling and Social Constructivism

The social aspect of knowledge construction is supported by Vygotsky's social constructivist learning theory, where the role of others, e.g., peers and parents, is significant in mediating a learner's access to new experiences and assisting them in acquiring new knowledge (Ng & Howard, 2015). Society is the source of human knowledge, and there is a dynamic interdependence of individual and social processes in the construction of knowledge. Therefore, social interaction is very important when learning experiences take place, as learners feel motivated to

participate and share their ideas (Schoonen, 2016). Also, a socially constructive learning environment should facilitate the provision of feedback to learners (Naroth, 2010). For more effective feedback, the teacher should facilitate discussion in groups or even with the whole class in which learners explain the thinking on which they based their answers.

The role of social interaction becomes evident when students create their digital stories in groups (Schoonen, 2016). Also, the whole process of digital storytelling provides students with many opportunities for social learning, both for student audiences and students sharing their stories as they observe other students' reactions to their work (Shin, 2016). When students share their ideas and explain them to each other, they also feel more confident in the process of acquiring new knowledge (Schoonen, 2016). By creating a digital story, a writer attempts to imagine relationships between themselves and the world, especially when digital storytelling is used as a media type. A central principle of digital storytelling is to share the stories one creates. In this respect, a digital story is a highly personal experience designed to be told in a very public way (Lundby, 2008). The social practice of sharing stories allows audience members to learn and reflect on their stories, even during the final observation phase of the project's presentation section (Shin, 2016). The connection between an individual and their social world is the importance of digital storytelling for both a creator and their audience. Social learning occurs both in the construction of the story and in the process of integrating the digital aspects of the digital narrative. The process of selecting the appropriate material for a digital narrative so that the appropriate meanings are conveyed to the audience is where learning takes place (Nguyen, 2011).

Furthermore, peer teaching of students through digital storytelling can be useful and academically powerful. Without feeling or being skilled, students do a common good for each other. Social learning is a hallmark of digital storytelling (Alexander, 2011). Digital storytelling bridges the gap between individual and social activity. Building a digital story is a dual socialized activity. While a creator relies on their life experience as the main material for creating a story, they must be integrated into the social world in most, if not all, of the steps of creating the story (Nguyen, 2011). The connection between a learner and the target group for whom they are creating

digital stories is an element related to the social process in the creation of a digital narrative (Normann, 2011). In fact, this constitutes the coordination of the traditional interaction between the storyteller and the audience from the time when stories were told around the fire. The narrator always adjusted the story according to the audience's reactions (Nguyen, 2011). In particular, the best students pay great attention to the target group for their creations (Normann, 2011).

Finally, the process of creating digital stories needs and produces learning communities. Digital stories would not be so deep and powerful without this community element. Part of the process of creating digital stories involves sharing and disclosure. This happens incrementally in classrooms. Students might think, "I can really relate to this story because something similar happened to me," and the conversation transitions into personal narrative and disclosure. Digital stories creates a sense of cross-cultural understanding. The story and individual merge and produce a deeper picture of that person's social reality, creating a deep level of cultural respect (Benmayor, 2008).

Digital Storytelling and Constructionism

Constructionism (Papert & Harel, 1991) is a learning theory based on the belief that knowledge is constructed by learners themselves through active intellectual processes. According to constructionism, when children are faced with completing an authentic and personally relevant activity or solving a problem, they are prompted to investigate and represent knowledge correctly (Di Blas & Boretti, 2009). Papert interprets constructionism, as opposed to constructivism, as the "personal reconstruction of constructivism" where the role of knowledge construction in the "world" rather than in the "mind" is emphasized (Papert, 1993). A distinctive feature of constructionism is "learning by making," which is different from the constructivist "learning by doing." The concept of "learning by making" emphasizes learning that takes place when students engage in making external and shared objects, like creating and sharing stories enhanced by photographs, voices, and soundtracks (Wang & Zhan, 2010). The construction of a digital story focuses not only on the intellectual construction of knowledge but also on the physical construction of a tangible product or object. Students are more excited and engaged in learning if they

construct an object that others will see, critique, and use (Papert, 1991; Ng & Howard, 2015). Banaszewski (2015) argues that digital storytelling is a constructionist learning activity (Papert, 1991) since, in the constructionist learning theory, a learner is involved in creating something external or at least shareable, like a machine, computer program, or digital video.

Digital storytelling offers much more than an opportunity for learning based on the development of a project involving technology. In fact, when digital storytelling incorporates constructionist learning theory, it can move the pedagogical logic of teaching from simply testing knowledge to one that aims to acquire skills and metacognition (Tang, 2016). By emphasizing reflection and knowledge sharing among communities, the constructionist approach supports entire processes and, ultimately, products of teaching and learning through digital storytelling (Solidoro, 2007).

Digital Storytelling and Narrative Learning

Goodson and Gill (2011) provided a grounded theory on narrative learning, arguing that the act of storytelling one's life is a continuous, episodic, meaning-making process that leads to a deeper understanding of oneself by contributing to one's existence. Every human being has numerous stories to tell because a story based on life experience is simply a point of intersection of different components, including culture, ethnicity, history, society, economy, etc. Human life is essentially a series of narratives because our life experience is stored in our memory in narrative episodes. Narrative knowledge is epistemologically distinct from scientific knowledge.

Stories are effective educational tools because one can believe them, remember them, and be entertained by them (Neuhauser, 1993; Wang & Zhan, 2010). According to Hopkins (1994), storytelling is the process through which learners make sense of their experiences and educational content. If we recognize that narrative is a basic process through which humans make sense of their experiences and that learning is related to this process, then clearly, narrative methods are not only appropriate but also necessary to support learning. Furthermore, narrative learning in technology-supported environments can, according to Dettori and Paiva (2009), promote the meaning-making process, as well as the development of cognitive skills,

while technology can enhance the potential of learning through narrative. Recognition of narrative pedagogy serves to strengthen the core of digital storytelling and frames its appropriate and effective use. Digital storytelling can provide a central opportunity for both teachers and their students to become familiar with narrative pedagogy. Narrative literacy is an increasingly essential skill for today's students (Garcia & Rossiter, 2010).

The power of digital storytelling is often wrongly assumed to lie in multimedia because it offers the writer a wide variety of means of expression. In fact, the narrative makes digital stories interesting (Ohler, 2008). The digital dimension of digital storytelling has its own advantages, but multimodality is a strength and a challenge for digital storytelling. If used well, multimodality can no doubt achieve a great expressive power that can bring about a real expressive lift to a story. Otherwise, it will convey sadness that will kill the story or "make the story's flaws more obvious," like when "a bad guitarist uses a bigger amplifier" (Thornburg, 2008).

Digital Storytelling and TPACK Theory

Technological Pedagogical Content Knowledge theory (TPACK; Mishra & Koehler, 2006) focuses on how technology can be used to (a) develop new knowledge and (b) enhance existing skills (Mishra & Koehler, 2006; Tang, 2016). Mishra and Koehler (2009) argue that the “heart” of good teaching using technology involves three components: content (teaching material), pedagogy, and technology. These three components form the three intersecting circles of the "Technological Pedagogical Content Knowledge Framework," while the intersections created by each two circles represent three additional types of knowledge, with the intersection of all three circles representing TPACK.

Robin (2008) states that digital storytelling is based on the TPACK framework. One application of the TPACK framework is digital storytelling, as it integrates technology, pedagogy, and content knowledge. In a study (Kildan & Incikabi, 2013), thirteen teacher candidates were assessed on their training in the TPACK framework before and after watching and creating digital stories. Specifically, after being given a theoretical presentation of the TPACK framework, they responded to a questionnaire about it. They then watched two digital stories and created a digital story about

teaching children mathematics. Finally, they responded to another questionnaire related to the TPACK framework. The results of the study showed a shift from the dual intersections of technology, pedagogy, and content to the triple intersection of TPACK.

The intersection of the TPACK framework and digital storytelling is based on technology being used in classrooms to promote meaningful learning opportunities (Harriman & Branch, 2012). Digital storytelling is an educational approach that can motivate students to learn more about content using multimedia technology. Teachers should have a deep knowledge of teaching, teaching methods, multimedia technology, and know-how to combine the convergence of these three types of knowledge in their teaching. In this way, teachers can motivate students to learn new content more effectively (Tang, 2016).

Digital Storytelling and Cognitive Theory of Multimedia Learning

The Cognitive Theory of Multimedia Learning was first adopted by Richard Mayer in 1997. Mayer developed this theory based on Thomas Edison's (1922) hypothesis that motion pictures would revolutionize education. According to it, an individual learns and engages better in a learning environment that contains more than one form of media (Mayer & Moreno, 2003; Schoonen, 2016).

The use of multimedia in learning induces three very important cognitive processes: selection, organization, and integration (Mayer & Moreno, 2003; Schoonen, 2016). Selection involves a process of manipulating visual and verbal messages, organization explicates verbal and visual messages, and integration refers to the ability to connect verbal and visual messages to prior knowledge. Digital stories containing pictures, words, and narration fit the above model perfectly. Students who watch the stories and listen to the narration are more likely to have a successful learning experience. When students choose images to illustrate their thoughts and write a narrative about the meaning of the images, they are engaged in selecting and organizing their ideas. Integration takes place when students' prior knowledge about the topic begins to connect. For example, when students learn the properties of shapes, new content can indicate the properties, while prior knowledge refers to a student knowing what a square looks like by recalling a picture and making a

connection between the words (name of the shape) and the picture (what it looks like).

Learning takes place in an environment where learners can interact with the material they are studying. The use of multimedia in a classroom can create anticipation, motivation, and excitement (Sorden, 2005). Fostering anticipation keeps learners' interest active, which is a motivation to learn. Providing motivation helps students conquer initial fears and gain enthusiasm and willingness to experiment, which leads to learning. This underlines the value of integrating multimedia in education. Using digital stories motivates students to learn because they can organize the learning content as they understand it. Using digital stories can increase positive emotions because it helps students experience learning in a fun and interactive way. Learners are encouraged to create digital stories using drawings or photographs, voice files or sounds, and text that represents their interpretation of the theoretical content they are being asked to manage. These learning experiences are an application of the cognitive theory of multimedia learning as learners are exposed to multimedia to create, interpret, and apply newly acquired content. The creation of digital stories allows learners to organize, select, and integrate learning content into logical clusters of these three cognitive processes that are highly important in learning (Mayer & Moreno, 2003).

Digital Storytelling and Discovery Learning

One approach that can enhance students' cognitive engagement and create a meaningful learning experience is discovery learning (Bruner, 1961). Bruner (1961) defined discovery as the process of acquiring knowledge using one's personal thinking and even considered humans as "information processors." Discovery learning is characterized by complex cognitive processes related to the acquisition, processing, and transformation of information and is a learning paradigm that places greater emphasis on learners as active participants in the learning process.

Digital storytelling is an appropriate method of applying discovery learning because it encourages students to use digital media such as audio, video, and images to construct and convey knowledge to the viewer about a topic in the form of a story. The benefits of discovery learning using digital storytelling are particularly evident

when one observes Dale's Cone of Experience (Wiman & Meirhenry, 1969), which shows that active learning results in the highest level of knowledge retention. In their study, Bromberg, Techatassanasoontorn, and Andrade (2013) used digital storytelling as a learning strategy by asking students to construct new knowledge by connecting information systems concepts to real-world computer applications and then share this new knowledge with the rest of the class in the form of a story. This type of learning activity, can yield very high knowledge retention for students and promotes higher-order learning outcomes, including critical analysis and assessment, because students become creators of their own digital stories.

Digital Storytelling and Andragogy

"Andragogy" (Knowles, 1984) is the best-known adult learning theory. This theory was developed by Malcolm Knowles, who considered it an "integrated theory of adult learning" and placed it in the realm of humanistic approaches to adult education. Andragogy argues that adult learners have certain characteristics that differentiate them from children. Thus, they need a different type of education from that of children and adolescents. Three key principles of the andragogy learning theory (Knowles, 1984) are the creation of experiential learning, self-direction, and the use of personal voice. Digital storytelling is based on all three of these principles.

The creation of experiential experiences has been a fundamental element since the introduction of andragogy learning theory. The creation of a digital narrative is an essentially experiential experience, as a learner creates their own digital story. Three areas where storytelling can be applied in adult teaching and learning are (a) the use of stories in classrooms to illustrate and highlight specific points of the subject matter to be learned, (b) the 'historicization' of the curriculum, i.e., describing the curriculum in narrative form, and (c) autobiographical learning, i.e., learning through personal stories and experiences (Rossiter & Clark, 2007; Rossiter & Garcia, 2010). According to the andragogy learning theory, self-directed learning as a process, the autonomy of an adult participating in a learning process, and the relationship between the two are significant. McAdams (1996) states that our life is a story, unfolding and developing throughout our existence. We are the main characters and authors of our life stories and, therefore, not just victims of circumstance; we are the

decision-makers and navigators. Narrative educational methods offer adult learners opportunities for self-directed learning and the ownership of learning. Also, when creating a digital story, not only self-direction and ownership are involved but also self-presentation because a learner, guided by their experiences, creates a personal project that they showcase. As Robin (2008) explains, digital storytelling offers an opportunity for personal expression through multimedia and the opportunity to become the director of one's own film, which is particularly appealing and empowering for adult learners. Finally, another concept close to the core of adult education is that of voice. A distinguishing feature of digital stories is the inclusion of a person's natural voice in the story they create. While this may sound obvious, we believe it should not be underestimated. Our voices reveal much about who we are (Rossiter & Garcia, 2010).

Conclusions

It is evident that Educational Digital storytelling with its creative, exploratory and collaborative character fits perfectly with a number of modern learning theories. In this article we presented how Educational Digital Storytelling is supported by (a) constructivism, (b) social constructivism, (c) constructionism, (d) narrative theory, (e) technological pedagogical content knowledge theory, (f) cognitive theory of multimedia learning, (g) discovery learning, and (h) andragogy theory. The main limitation of this article is that it does not detail all the learning theories that are connected with Educational Digital Storytelling. That is the aim of a future more extensive version of this article.

References

Alexander, B. (2011). *The New Digital Storytelling: Creating Narratives with New Media*. Santa Barbara, CA: Praegen Editions.

Banaszewski, M. T. (2005). Digital storytelling: Supporting digital literacy in grades 4-12 (Master's thesis). Georgia Institute of Technology, Atlanta, Georgia.

Benmayor, R. (2008). Digital Storytelling as a Signature Pedagogy for the New Humanities. Arts and Humanities in Higher Education, 7(1), 188-204.

Bromberg, N.R., Techatassanasoontorn, A.A., & Diaz, A. (2013). Engaging Students: Digital Storytelling in Information Systems Learning. Pacific Asia Journal of Association for Information Systems, 5(1), 1-22.

Bruner, J. S. (1961). The act of discovery. *Harvard Educational Review*, *31*, 21-32.

De Houwer, J., Barnes-Holmes, D., & Moors, A. (2013) What is learning? On the nature and merits of a functional definition of learning. Psychonomic Bulletin & Review 20, 631-642.

Di Blas, N., & Boretti, B. (2009). Interactive storytelling in pre-school: a case-study. In Proceedings of IDC 2009, ACM, New York, NY, 44-51.

Dimitriadis, S. (2015). Learning theories and educational software. Athens, Greece: Kallipos Publishing.

Feher, P. (2008). Towards effective student-centered, constructivist learning: Build Your Own Digital Story! (A Hungarian Case Study). In J. Luca & E. Weippl (Eds.), Proceedings of EdMedia: World Conference on Educational Media and Technology 2008, Association for the Advancement of Computing in Education (AACE), 2364-2367.

Garcia, P., & Rossiter, M. (2010). Digital storytelling as narrative pedagogy. In D. Gibson & B. Dodge (Eds.). Proceedings of Society for Information Technology & Teacher Education, 1091-1097.

Harriman, C. S. (2011). The impact of TPACK and digital storytelling as a learning experience for pre-service teachers in a learning-by-designing project (PhD Thesis). University of Georgia.

Harriman, C. L. S., & Branch, R. M. (2012). Aligning digital storytelling to the TPACK framework: A learning experience for pre-service teachers in a learning-by-designing project. In Anais do Workshop de Informática na Escola, 1(1), 1-10.

Kildan, A. O., & Incikabi, L. (2013). Effects on the technological pedagogical content knowledge of early childhood teacher candidates using digital storytelling to teach mathematics. International Journal of Primary, Elementary and Early Years Education, 7(3), 1-11.

Knowles, M. (1984). The Adult Learner: A Neglected Species. (3rd Ed.). Houston, TX: Gulf Publishing.

Karantalis, N., & Koukopoulos, D. (2022). Utilizing digital storytelling as a tool for teaching literature through constructivist learning theory. SN social sciences, 2(7), 109. https://doi.org/10.1007/s43545-022-00412-w

Koehler, M. J., & Mishra, P. (2009). What is technological pedagogical content knowledge? Con temporary Issues in Technology and Teacher Education, 9(1), 60-70.

Naroth, C. (2010). Constructive teacher feedback for enhancing learner performance in mathematics (Master Thesis). University of Bloemfontein.

Ng, W., & Howard, N. (2015). iResilience of science pre-service teachers through digital storytelling. Australasian Journal of Educational Technology, 31(6), 736-751.

Nguyen, A. T. (2011). Negotiations and challenges in creating a digital story: The experience of graduate students (Ed. D.). University of Houston.

Normann, A. (2011). Digital Storytelling in Second Language Learning (PhD Thesis). Norwegian University of Science & Technology.

Oliver, J. (2013). The importance of misconceptions in science teaching, In Proceedings of 7th International Technology, Education & Development Conference, 4-6 March 2013, Valencia, Spain, 4618-4621.

Papert, S., & Harel, I. (1991). Situating Constructionism. In S. Papert & I. Harel (Eds.), Constructionism. Norwood, NJ: Ablex Publishing.

Posner, G.J., Strike, K.A., Hewson, P.W. & Gerzog, W.A. (1982). Accommodation of a scientific conception: toward of conceptual change. Science Education, 66, 211-227.

Robin, B. (2008). Digital storytelling: A powerful technology tool for the 21st century classroom. Theory into practice, 47(3), 220-228.

Roschelle, J. (1995). Learning in interactive environments: prior knowledge and new experience. Public institutions for personal learning: establishing a research agenda. In Falk, J. & Dierking, L. (eds.). Washington: American Association of Museums.

Rossiter, M., & Garcia, P. A. (2010). Digital Storytelling in Adult Education: Toward a Conceptual Framework, Adult Education Research Conference, Sacramento, 422-428.

Schoonen A. (2016). Digital storytelling as Mathematics teaching strategy to encourage positive learner engagement in the Foundation Phase (Master Thesis). North-West University.

Shin, E. (2016). Constructivist Learning Environments in Digital Storytelling Workshops: An Interview with Joseph Lampert (PhD Thesis). Pepperdine University, Gratuate School of Education & Psychology.

Smeda, N., Dakich, E., & Sharda, N. (2013). The Effectiveness of Digital Storytelling in the Classrooms. A Comprehensinve Study. Smart Learn. Environments, 1(6), 1-21.

Sorden, S. D. (2005). A cognitive approach to instructional design for multimedia learning. Informing Science Journal, 8, 263-279.

Spector, M. J. (2016). Foundations of Educational Technology. New York, NY: Routledge Editions.

Strike, K. A., & Posner, G. J. (1992). A revisionist theory of conceptual change. New York, State University of New York Press.

Swan, M. (2005). Improving Learning in Mathematics: Challenges and Strategies (Standards Unit). Department for Education and Skills Standards Unit. University of Nottingham

Sweeney-Burt, N. (2014). Implementing Digital Storytelling as a Technology Integration Approach with Primary School Children. Irish Journal of Academic Practice, 3(1), 1-25.

Tang, S. (2016). Digital Storytelling Approach in a Multimedia Feature Writing Course. Journal of Language Teaching and Research, 7(3), 572-578.

von Glasersfeld, E. (1999). 'How Do We Mean? A constructivist sketch of semantics'. Cybernetics & human learning, 6(1), 9-16.

Wang, S., & Zhan, H. (2010). Enhancing teaching and learning with digital storytelling. International Journal of Information and Communication Technology Education (IJICTE), 6(2), 76-87.