Artigo

Promoting narrative competence and media literacy in early childhood education through digital storytelling. A research instrument for analysing digital stories

Promover a competência narrativa e a literacia mediática na educação infantil através da narração digital de histórias. Um instrumento de pesquisa para analisar histórias digitais

Promoción de la competencia narrativa y la alfabetización mediática en la educación infantil a través de la narración digital. Un instrumento de investigación para analizar historias digitales

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Abstract

The Erasmus+ STORIES research project ("Fostering early childhood media literacy competencies", 2015-2018) pursued the general objective of defining and disseminating guidelines and best practises for media education in early childhood education through digital storytelling, based on theoretical and empirical research. The research design mapped this general objective to the different dimensions of media education and assigned a prominent role to narrative competence. Thus, digital storytelling was placed in the context of broader school or classroom projects dealing with narrative languages and asking children generative questions about the idea of story and storytelling and the possibilities of digital storytelling. Consequently, among the various criteria for evaluating multimodal productions, the coherence of the narrative discourse plays a central role: the question arises as to what are the most salient features of the practises associated with the best crafted stories, i.e. the most complete and narratively organised. This paper focuses on a research instrument developed and validated within the project, which can also be used in other contexts to obtain comparable research data.

Resumo

O projeto de pesquisa Erasmus+ STORIES ("Fostering early childhood media literacy competencies", 2015-2018) buscou o objetivo geral de definir e disseminar diretrizes e práticas recomendadas para a educação midiática na educação infantil por meio da narração de histórias digitais, com base em pesquisas teóricas e empíricas. O projeto de pesquisa mapeou esse objetivo geral para as diferentes dimensões da educação para a mídia e atribuiu um papel de destaque à competência narrativa. Assim, a narração de histórias digitais foi inserida no contexto de projetos mais amplos da escola ou da sala de aula que lidam com linguagens narrativas e fazem perguntas geradoras às crianças sobre a ideia de história e narração de histórias e as possibilidades da narração de histórias digitais. Consequentemente, entre os vários critérios de avaliação

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das produções multimodais, a coerência do discurso narrativo desempenha um papel central: surge a pergunta sobre quais são as características mais marcantes das práticas associadas às histórias mais bem elaboradas, ou seja, as mais completas e organizadas narrativamente. Este artigo se concentra em um instrumento de pesquisa desenvolvido e validado no projeto, que também pode ser usado em outros contextos para obter dados de pesquisa comparáveis.

Resumen
El proyecto de investigación Erasmus+ STORIES ("Fostering early childhood media literacy competencies", 2015-2018) perseguía el objetivo general de definir y difundir directrices y buenas prácticas para la educación mediática en la educación infantil a través de la narración digital, basándose en la investigación teórica y empírica. El diseño de la investigación relacionó este objetivo general con las diferentes dimensiones de la educación mediática y asignó un papel destacado a la competencia narrativa. Así, la narración digital se situó en el contexto de proyectos escolares o de aula más amplios que abordaban los lenguajes narrativos y planteaban a los niños preguntas generativas sobre la idea de cuento y narración y las posibilidades de la narración digital. En consecuencia, entre los diversos criterios de evaluación de las producciones multimodales, la coherencia del discurso narrativo desempeña un papel central: se plantea la cuestión de cuáles son las características más destacadas de las prácticas asociadas a las historias mejor elaboradas, es decir, las más completas y organizadas narrativamente. Este artículo se centra en un instrumento de investigación desarrollado y validado en el marco del proyecto, que también puede utilizarse en otros contextos para obtener datos de investigación comparables.

Keywords: Early Childhood Education, Story Telling, Media Literacy, Story Grammar

Palavras-chave: Educação Infantil, Contação de Histórias, Alfabetização Midiática, Gramática de Histórias

Palabras clave: Educación de la Primera Infancia, Narración de Cuentos, Alfabetización Mediática, Gramática de Cuentos

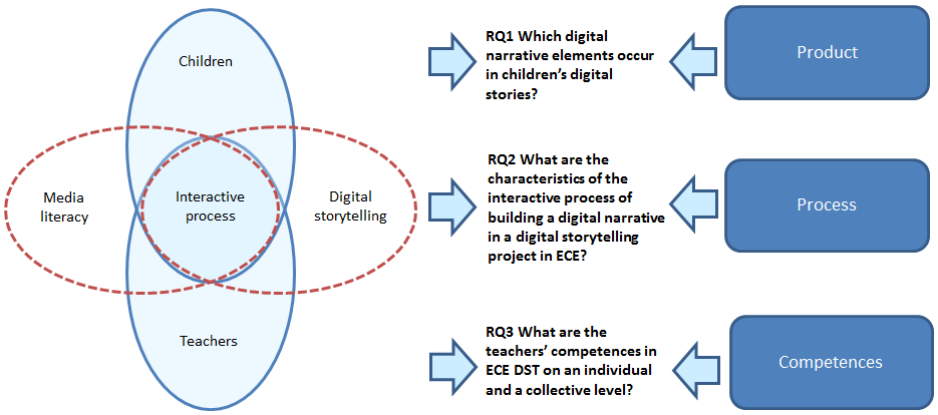
1. Introduction

The topic of digital storytelling (DST) in education, understood as a narrative methodology that implies a critical reflection on the use of media, has long received constant attention, also in the Italian context, where extensive research and experience have shown its potential both for teaching and for educational documentation (Ohler, 2008; Petrucco & De Rossi, 2009; Yuksel, 2011; De Rossi & Petrucco, 2013; Boase, 2013; De Rossi & Restiglian, 2013; Di Blas, 2016). In this area, the Erasmus+ project STORIES (“foSTering early childhOod media liteRacy competencIES”, 2015-2018) was characterised by the fact that it focused exclusively on ECEC and precisely defined two main objects of investigation: firstly, the development of children's narrative, media and social skills through digital storytelling; secondly, the professional skills of teachers suitable to support this (Bonaccini & Contini, Eds, 2019; Bertolini, 2017; Bertolini & Contini, 2017). The aim of the project, in fact, was not to promote the introduction of digital devices in kindergartens to teach children technical skills, but on the contrary, to gain insights from the literature and field research on the possible integration of an operational method in the preschool curriculum aimed at promoting children's multimodal (verbal and non-verbal) narrative competence

and their cultural awareness in the active use of digital tools, of which they are often passive users from an early age. Overall, the project investigated the dimensions of 1) children's media literacy and 2) teachers' ability to support them in the context of digital storytelling. In terms of children's media literacy, we can look at the products and the process, considering the interplay between narrative goals and the possibilities of digital tools. Looking more closely at these two dimensions, we have identified three common research themes that relate to three perspectives: the product perspective, the process perspective and the teacher competences perspective. For each perspective, the research group defined a common research question to be answered by all partners (Figure 1):

- What digital narrative elements occur in children's digital stories?
- What are the characteristics of the interactive process of creating a digital narrative in the context of ECEC?
- What competences do teachers need in the field of ECE DST on an individual and collective level?

Figure 1 - Research themes and questions

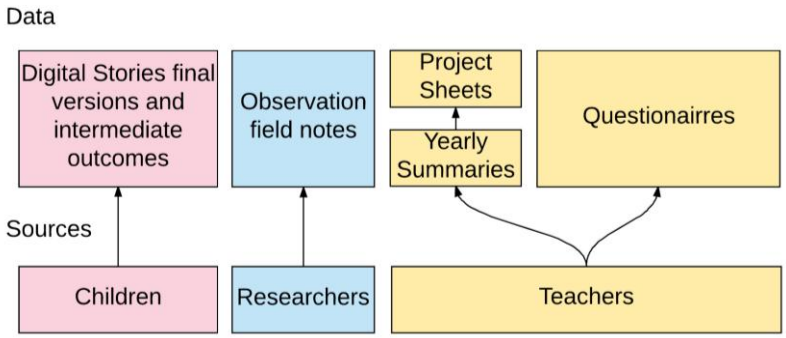


Source: Nousiainen, ed. (2018). *STORIES: Scientific Research Report (IO2)*, p. 27.

The research methodology followed design-based research (DBR) and involved two cycles in which teachers used digital storytelling with children as part of the STORIES project. The DBR framework, which emphasises collaboration between researchers and practitioners, aims to advance learning theory, pedagogical practise and the design process (Wang & Hannafin, 2005; Barab & Squire, 2004). The foundation for these initiatives was laid during a researcher-led DST training course in autumn/winter 2016-2017 (Zini et al., 2018). Based on a review of the reference literature, a number of methodological suggestions were made to teachers on how to support the invention of digital stories in the preschool context via two main routes: fictional play and deliberate invention. In fictional play with peers, narrative thinking finds an important opportunity for stimulation: indeed, confrontation with peers in the construction of common play plots requires the elaboration and clarification of one's own narrative contributions. Teachers may therefore decide to invent digital stories together with the group and draw substance from this spontaneous activity (Yuksel, 2011). Alternatively, it is possible to set up projects in which the children intentionally

invent a story that is then told digitally to an audience (Boase, 2013). In particular, the trainers introduced teachers to a perspective found in the literature (Ohler, 2008) that suggests inventing the story orally first and integrating the sound and visual channel at a later stage: To facilitate the integration of the latter, the possibility of using simple storyboards was also discussed (Petrucco & De Rossi, 2009). Educators designed narrative-based classroom activities under the guidance of the researchers while finalising the research instruments for data collection. The digital storytelling activities began in the kindergartens in January 2017, with the first cycle lasting from January to June 2017. Nineteen kindergartens in Finland, Germany, Italy and Turkey took part in the project activities. The educators carried out three projects per cycle, with breaks for sharing findings and refining and adapting the research instruments based on the feedback. The subsequent series of projects, which took place from September 2017 to March 2018, allowed educators to reflect on and adapt their approaches, incorporating feedback and experience. The research team accompanied the data collection in a non-intrusive manner. The preliminary analysis after the first cycle served as a basis for improvements in the second cycle. After the second cycle, the research team conducted a comprehensive analysis that culminated in the reporting of the findings (Nousiainen, ed., 2018; Gözen et al., 2018; Bertolini & Pagano, 2018; Gözen & Cirik, 2017). All research instruments and codebooks were published as an appendix to the STORIES IO2 research report, which can be accessed in the "Results" section of the project page digitalstorytelling.eu.

Figure 2 – Data sources



Various types of data were collected as part of the project (Figure 2), including artefacts, documentation, questionnaires and interviews as well as observational data. In each country, the local research partner was responsible for collecting all research data. All partners used a common set of core instruments to ensure comparability of the data collected. Common guidelines and rubrics were developed for analysing less structured data, such as digital stories (Zini *et al.*, 2020), which are our main topic here.

2. Analysing the digital stories

Narration can be understood as a medium for conveying social and personal identities (Ochs, 1997), so that its significance goes far beyond socialisation to language. Here we take a particular perspective on such a complex subject. Children's narratives have long been the subject of studies that aim both to identify the cognitive and linguistic structures underlying narrative

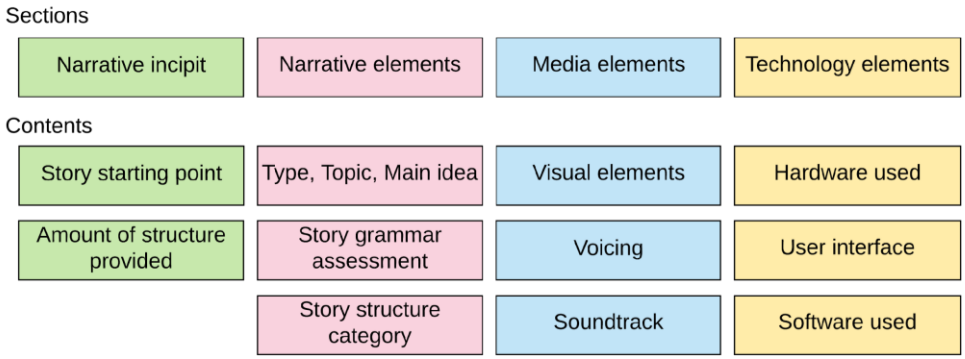
competence and to examine the stages of development. The developmental psychology literature (Baumgartner et al., 2000; Hudson & Shapiro 1991; McCabe & Peterson 1991) recognises that narrative competence involves the integration of conceptual, linguistic, structural and pragmatic knowledge. Given the predictive importance of early narrative competence for later academic achievement in literacy (e.g., McCabe & Rollins, 1992), a considerable amount of research has been devoted to understanding the developmental trajectory of children's narrative competence in early childhood. Differences in the production of decontextualised discourse, such as narratives, are evident even among children from the same cultural background, and the nature of narrative interactions between adults and children is likely to be a critical factor in fostering children's narrative skills (Peterson & McCabe, 1994). The onset of narrative use represents a crucial stage in progressive language development. In order to tell or understand a story, a child must have the ability to think about and combine linguistic, cognitive and social skills (Karmiloff & Karmiloff-Smith, 2002). Preschoolers show a greater ability to organise their spoken personal narratives with sophistication than their ability to structure general scripts relating to normal experiences or fictional stories (Hudson & Shapiro, 1991). Children also share a variety of narrative forms with each other, including personal anecdotes, retellings of films, and fantasy stories. However, most of their conversational narratives centre on real personal experiences. The genre of fictional narrative is more structured and follows formalised and common rules, often referred to as "grammars". These grammars define basic elements and create a macro-structure that guides and shapes the course of events. An explicit facet of narratives that exhibit a recognisable developmental sequence is knowledge of narrative structure, i.e. the cognitive representation of the structure of stories (Stein & Glenn, 1979). Episodic structure has been used to elucidate decontextualised processes of discourse construction and the use of cohesive devices in imaginative narratives (Orsolini, 1990). In the early preschool and kindergarten years, children actively acquire knowledge about story structure, which includes both the components of a story and their interrelationships to construct a coherent plot. Researchers have noted a developmental trend showing an increase in the overall production of story structure components (e.g., Castilla-Earls et al., 2015) and have gained an understanding of the sequential emergence of individual story components, particularly during the period when story structure is developing most rapidly (Khan et al., 2016).

The importance of carefully integrating storytelling into the curriculum for preschool children and promoting it through specific settings and strategies (Bondioli, 2004) has increased over time. On the other hand, there are still few studies on digital storytelling in preschool and there is a lack of specific instruments to assess the outcomes in terms of narrative development. The instrument for analysing digital (i.e. multimodal) stories developed within the STORIES project could remedy this lack. The first research question of the STORIES project focuses on the children's product perspective and media literacy, i.e. it analyses the final digital stories created by the children during the digital storytelling activities. The concept of “digital narrative elements” integrates the narrative and media elements and emphasises the possibilities and opportunities of different digital tools for multimodal storytelling. As the stories are created with different tools and techniques, the aim is to analyse how the stories look in relation to the narrative features supported by the digital dimension and

how the stories reflect the tools used and vice versa. The actual artefacts produced by the children during the activities carried out in the kindergartens are the main source of data for RQ1. The researchers analyse the stories to identify the digital narrative elements used by the children. Teachers are asked to complete a project sheet (plan and report) in a fixed format for each project they carry out with the children. Using the project sheet, teachers describe the activity, give their evaluation and write down additional notes and comments relevant to the activity. For RQ1, the role of the project sheets is to set the context to help researchers interpret the finished stories and the possibilities of technology for storytelling.

The instrument for analysing digital stories produced in ECE contexts (Zini et al., 2020) considers contextual, narrative, media and technological elements (Figure 3). Before being applied to the analysis of the artefact corpus, the instrument was validated on a sample of short films produced in the 2016-2017 school year. The instrument is accompanied by a detailed coding guide for researchers.

Figure 3 – Digital Story Evaluation Form.



The first section of the data analysis tool is dedicated to the beginning of the story creation process: the type of stimulus that triggered the group activity (stories, drawings or games by the children or ideas from the teacher) and the extent of the narrative structure it contains. The second section analyses the narrative aspects of the product: the narrative genre (script, personal narrative or story, according to the well-known definition of Hudson and Shapiro, 1991), the presence/absence of the constituent elements of a story and the observation of regularities in the narrative structure (for which the cognitive model and the categories of "story grammar", originally proposed by Stein & Glenn, 1979, were mainly used). The third section analyses the audiovisual elements of the artefact: the type of product (sequence of still images; sequence of images with animations; animated drawing or stop-motion shot; filmed from life); the presence of images produced by children; the narrative voice and dialogues; diegetic and extradiegetic music; the sound effects. The final chapter of the analysis looks at the different devices and application programmes used by children and/or teachers in the production and post-production of the artefacts. Overall, the instrument explores variables related to pedagogical, narrative, media and technological elements to be measured in order to investigate the possible relationships between the observed outcomes and the different strategies, tools and practises for multimodal storytelling in ECEC.

2.1 The narrative incipit

The section of the analysis instrument dedicated to the incipit naturally concerns a specific aspect of the process of creating the digital stories that is not directly reflected in the results. However, its function within the instrument is closely related to the evaluation of the narrative quality of the product, which implies that the main factors influencing the task of creating a coherent story are kept under control. In this section, we have defined the two variables that make up the incipit: the type of stimulus initially offered to the narrators, i.e. the initial cue, and the elements of narrative structure already contained therein. A third influencing factor is the narrative genre, as defined by Hudston and Shapiro (1991), based on structural and content features, such as scripts, personal narratives or fictional stories, which are typically accessible at different ages during the development of the child's narrative competence with varying degrees of complexity and mastery; this element, which can be observed in the final products, is explored in the next section of the instrument (see paragraph 2.2).

The data on the beginning of the process of creating digital stories come, in some cases, from the reports written by the researchers during the observation sessions and, in all cases, from the corresponding paragraph in the form completed by the teachers for each project carried out. This latter document, the scheme of which was developed by the research group, requires teachers to describe the stimulus from which it originates immediately after starting the activity with a group of children, proposes two classes of incipits differentiated according to whether the stimulus originates from adults or from children, and offers some examples of each. For the definition of the two categories of adult-derived stimuli, reference was made to the study by Heldberg & Stoel-Gammon (1986: 59): In the instrument used by the researchers to analyse the stories, the first variable is nominal in nature and is defined as the starting point of the story. Based on the information provided by the teachers and the data collected through observation, the researchers are asked to categorise the starting point by selecting one of the four modes that the variable can take (Table 1).

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Table 1 – Starting point of the story.

Based on Project Sheet Section V, decide whether the development of the digital story started from an initial children's (1 or 2) or teachers' prompt (3 or 4). Choose only one answer.
1. Children's play scripts The narrative incipit has been drawn upon / extracted from children's play, e.g. □ acting / role play; □ manipulating tangible objects and imbuing them with personalities; □ free (playful) use of any kind of digital device (e.g. camera, tablet, iTheater, etc.).
2. Children's narratives The narrative incipit has been drawn upon / extracted from children's narratives, maybe spontaneous or somehow elicited, e.g. □ personal or conversational (oral) narratives (e.g. circle time); □ drawings, pictures (visual narratives).
3. Stimuli for original construction The teacher provided a verbal, or visual, or tangible, or multimodal stem, introducing one/some story element/s (not a complete story), e.g. □ a single picture, or a set of pictures (e.g. story dice, flash cards), or a sequence of related pictures (e.g. silent book, photo album);

□ a verbal content stem (e.g. a starting sentence); □ tangible objects (either natural or artificial: toys, dolls, puppets, bricks, figures, shapes, etc.) to be used as characters or as setting elements; □ teacher's recall of shared memories (oral telling of past experiences, maybe showing pictures, e.g. a school trip); □ conversational elicitation procedure (telling a story to get a story, i.e. providing a story model).
4. Stimuli for story retelling The teacher provided a complete story as a starting point, e.g. by improvising, or reciting, or reading a story; □ reading and showing an illustrated book; □ showing a silent book; □ showing a movie, or cartoon.

The second variable is of the ordinal type and is defined as the extent of narrative structure implied by the original stimulus. A five-point scale proposed by Hutson-Nechkash (1990: 14) is used for classification (Table 2).

Table 2 – Amount of Narrative Structure Provided (I.E. Inherent on the Stimulus).

1. *No structure*. The child chooses the topic and formulates a narrative.
2. The child is given a topic and is asked to tell a story.
3. *Medium amount of structure*. The child is given one or more potential story charachters, a phisical setting, and possibily an event.
4. The child is given a starting prompt containing the setting, characters, and an initiating event and is asked to complete the story.
5. *High degree of structure*. The child is told a story, and is asked to reformulate that story.

Source: Hutson-Nechkash, 1990, p. 14.

2.2 Narrative elements

The analysis of the narrative aspects of the audiovisual artefacts that make up the "digital stories" must necessarily be carried out both in verbis and in re. It attempts to capture the totality of the meanings expressed by the various means of signification in order to fully appreciate the contribution that the spoken or written word, images, sounds and animations make to the coherence, cohesion and expression of the mental states of the characters in the story. A first set of variables (Table 3) describes the title, genre, theme, and content of the story.

Table 3 – Narrative Elements.

Title of the Story				
Type of narrative	Script	Personal Narrative	Fictional Story	Other
If *other*, define (e.g. description, report, etc.):				
Topic (e.g. nature, friendship, family, school, etc.)				
Brief summary				

The second variable in this section is defined as the type (or genre) of the children's narrative. The three modalities are described with reference to the well-known typology of Hudson & Shapiro (1991), to which a fourth "other" modality has been added, for which a brief description is requested from the rater.

For the definition of narrative type or genre, we refer to the typology proposed by Hudston and Shapiro (1991), some definitions of which are included in the coding guide (Table 4).

Table 4 – Type of Narrative.

Scripts	Scripts are accounts of what usually happens. They are reported in the timeless present tense and often use the general pronoun you. (Hudson & Shapiro, 1991: 93)
Personal narratives	Personal narratives are accounts of specific events that have been personally experienced. They are reported in the past tense from the perspective of a participant using personal pronouns. (Hudson & Shapiro, 1991: 95)
[Fictional] Stories	The structural characteristics of stories have been formalized into various types of story grammars. Despite some variations, there is considerable agreement on the minimally acceptable characteristics of the structure for a single episode story. It must include: (a) a formal beginning (e.g., "Once upon a time") and orientation to introduce setting and characters; (b) initiating events, that is, goal-directed actions; (c) a problem or obstacle to achieving the intended goal; (d) a resolution of the problem; and (e) a formal ending device. (Hudson & Shapiro, 1991: 100) Whether it is realistic or fantastic, it has to be a fictional story. No matter if it's not a complete episode: check value n.3 whenever it's fiction.
Other	…

2.2.1 Story structure

What follows is a series of dichotomous variables (Table 5), i.e. a checklist that guides the researcher in verifying the presence or absence of the components and the logical connections - temporal or causal - that make up the internal structure of an episode, understood as the basic unit of analysis of a story.

Table 5 – Story Grammar Assessment.

❑ yes ❑ no	Is a setting given?
❑ yes ❑ no	Are the characters described?
❑ yes ❑ no	Are the events presented sequentially?
❑ yes ❑ no	Is there a causal relationship between events?
❑ yes ❑ no	Is there an initiating event?
❑ yes ❑ no	Is an internal responsepresent?
❑ yes ❑ no	Is a goal present?
❑ yes ❑ no	Is there an attempt to attain the goal?
❑ yes ❑ no	Is there a consequence?
❑ yes ❑ no	Are multiple plans used to meet the goal?
❑ yes ❑ no	Is a partial or complete episode embedded in the episode?
❑ yes ❑ no	Are there two characters with separate goals and actions that influence the actions of the other?

Source: Hutson-Nechkash, 1990, p. 19.

Completing the checklist developed by Peg Hutson-Nechkash (1990) with reference to the categories of the "story grammar" developed by Nancy L. Stein and Christine G. Glenn (1979) allows the researcher to assign a value to

the next variable (Table 6), which is defined as the structure of the story. Using the model proposed by Nancy L. Stein and Elizabeth R. Albro (1997), the stories that emerge from digital storytelling activities are categorised into four theoretically distinct categories. The four values of this ordinal variable represent the increasing adherence to the pattern of a "well-formed" episode through the addition of temporal and causal connections and the components of a goal-directed plot.

Table 6 – Story Structure.

1. No-structure sequence	Structureless sequence that does not revolve around an identifiable thematic core.
2. Descriptive/action sequence	Descriptive sequence or succession of actions that are chronologically ordered but not causally connected.
3. Reactive sequence	Sequence of automatic actions and reactions, i.e. linked by causal relationships but not purposeful.
4. Goal-directed sequence	Sequence of actions in which the intention of a character to achieve a goal is explicitly stated or can be inferred.

When possible, researchers can more accurately measure the degree of structural complexity of the story by relying on the developmental taxonomy for the acquisition of story grammar defined by Stein and Glenn (1980), which describes seven stages of increasing complexity, each containing all the components of the previous one and one additional one. The addition of an eighth level, corresponding to structural level zero, increases the number of values this ordinal variable can take to eight, which is described in the coding guide with reference to the work of Peg Hutson-Nechkash (1990: 18). The following table (Table 7) describes the characteristics of the different levels and shows the grouping of these within the four higher-order categories.

Table 7 – Levels of Story Grammar Development.

Category	**Level**	**Description**
No-structure sequence	Level 0. Unrelated Statements	Series of statements that do not revolve around an identifiable thematic core.
Descriptive/action sequence	Level 1. Descriptive Sequence	This story is comprised of descriptions of characters, surroundings, and usual actions of the characters. No causal relationships or sequences of events are present.
	Level 2. Action Sequence	This story consists of events in a chronological order but no causal relationships exist.
Reactive sequence	Level 3. Reactive Sequence	This story does contain a causal relationship in that certain changes automatically cause other changes. There is no evidence of goal-directed behavior.
Goal-directed sequence	Level 4. Abbreviated Episode	At this level, a goal is implied even though it may not be stated explicitly. This story contains either an event statement with a consequence or an internal response with a consequence. The actions of the characters seem to be purposeful, though not as well thought out as in successive stages.
	Level 5. Complete Episode	This story contains an entire goal-oriented behavior sequence. A consequence is required as well as two of the following three components: Initiating Event, Internal Response, Attempt.

	Level 6. Complex Episode	This level is an elaboration of the complete episode, with an additional partial or complete incident embedded in the episode. A story at this level could also contain multiple plans which are used to achieve the goal. Either one of these factors or both must be present.
	Level 7. Interactive Episode	The interactive episode is the highest level. This story contains two characters with separate goals and actions that influence the actions of the other.

Source: for description of levels 1 to 7, Hutson-Nechkash, 1990, p. 18.

The coding guide provides the rater with a summarised picture of the structural properties of the various structural patterns (levels), which were adopted from Hedberg and Stoel-Gammon (1986) and integrated here with the Story Structure Categories (Table 8).

Table 8 – Structural properties of story grammars.

Category	Level	Related Statements	Temporal Order	Causal Relations	Goal	Plan	Complications	Interaction
No-structure sequence	**Unrelated stetements**	-	-	-	-	-	-	-
Descriptive-action sequence	**Descriptive Sequence**	+	-	-	-	-	-	-
	Action Sequence	+	+	-	-	-	-	-
Reactive sequence	**Reactive Sequence**	+	+	+	-	-	-	-
Goal-directed sequence	**Abbreviated Sequence**	+	+	+	+	-	-	-
	Complete Episode	+	+	+	+	+	-	-
	Complex Episode	+	+	+	+	+	+	-
	Interactive Episode	+	+	+	+	+	+	+

Source: Hedberg & Stoel-Gammon, 1986, p. 67.

2.3 Media elements

The term "media elements" refers to the visual and auditory elements of digital stories, i.e. the directly observable features of the artefact (what the viewer can perceive as incoming material and therefore process through the visual and auditory channels). The first step of the analysis is to classify the artefact based on the configuration of its visual elements, which may correspond to different product types: These constitute the five modes that this nominal variable can assume (Table 9).

Table 9 – Product Type.

Still-image sequence	Animated slideshow	Animation	Movie	Mixed

Any kind of slideshow - e.g. storybook, photo/illustrated album, ppt presentation – whith no animations (other than transitions, e.g. fading effects).	E.g. animated ppt presentation.	Both *cartoon* and *stop motion* and *screencast*, i.e. the output of ITheatre, or any kind of app running on PC/Tablet/Smartphone employed for "live" or "delayed" animation, or screen recording: e.g. Puppet Pals, Camtasia, Monkey Jam.	Motion picture (live video record, maybe edited or not).	Mixed formats, e.g. the output of BookCreator, embedding both still image sequences and video clips.

The following variables (Table 10) analytically examine the presence and some characteristics of certain visual elements: written words and images produced by children.

Table 10 – Visual elements.

Are children's drawings, or written words embedded?			❑ YES ❑ NO	
If so, how were they produced?	By hand	Using digital tools		Both
Is written text displayed (e.g., screenplay, subtitles)?		❑ YES ❑ NO		
If so, does it integrate or substitute voicing?		Text integrate voicing	Text substitute voicing	Other

The researcher then examines the sound elements of the artefact (Table 11). First, the presence of a narrative voice and dialogue is examined. Second, if any kind of speech is present, the degree of intelligibility must be assessed on a four-point scale.

Table 11 – Sound Elements.

Is a narrating voice heard?	❑ YES ❑ NO			
Is dialogue used?	❑ YES ❑ NO			
If speech is present, please specify to what extent it is understandable.	Not at all	Hardly	Sufficiently	Clearly

A checklist is then proposed, consisting of five dichotomous variables covering different elements related to music and sound effects. As in the case of children visuals, the researcher is asked to consider not only the product but also aspects of the production process (Table 12).

Table 12 – Music and Sound Effects.

Mood music (non-diegetic)	❑ YES ❑ NO
Music (diegetic)	❑ YES ❑ NO
If present, was music played/sung/performed by children?	❑ YES ❑ NO
If present, was music created for the occasion?	❑YES ❑ NO
Sound effects	❑ YES ❑ NO

The definition of the categories relating to the soundtrack can be found in the coding guide (Table 13).

Table 13 – Soundtrack (Dichotomous).

Mood music (non-diegetic)	Music whose source is neither visible on the screen nor has been implied to be present in the action.
Music (diegetic)	Music whose source is visible on the screen or whose source is implied to be present by the action of the film. Diegetic music is any music presented as originated from source within the film's world. Digetic music can be either on screen or off screen depending on whatever its source is within the frame or outside the frame.
Sound effects	Sounds made by objects in the story, or sound effects which is added for the dramatic effect.

2.4 Technology Elements

The section dedicated to technological elements (Table 14) requires that the digital tools used to create the narrative are first analysed. For each tool, it must then be explicitly stated whether it was mainly used by children, teachers, none or both.

Table 14 – Hardware Used.

DEVICE	**USER**			
	None	Children only	Teacher only	Both
Computer (laptop/desktop; with keyboard, mouse/touchpad, and monitor as main in/output devices)				
Tablet device				
ITheatre				
Smartphone				
Camera				
Webcam				
Document câmera				
Digital Pen Camera/Microscope				
Interactive whiteboard (smartboard)				
Interactive projector (e.g. floor/wall graphics)				
Motion sensing input device (e.g. Xbox Kinect)				
Drawing pad				
Digital audio recorder				
Microphone				
Scanner				
Slide/overhead projector				
Printer				
Other				
If *other*, specify:	…			

The next section (Table 15) concerns the type of interface used by the children and teachers.

Table 15 – User Interface.

Define the kind of interface method between the human and the main device employed by the children.	
	Graphical user interface
	Touch user interface
	Tangible user interface
Define the kind of interface method between the human and the main device employed by the teacher(s).	
	Graphical user interface
	Touch user interface
	Tangible user interface

The definitions of the categories relating to the type of interface are included in the coding guide:

- Graphical user interfaces accept input from devices such as a computer keyboard and mouse and provide articulated graphical output on the computer monitor;
- Touch user interfaces are graphical user interfaces that use a touchpad or touchscreen display as a combined input and output device. Touchscreens are screens that accept input by touching with fingers or a stylus (e.g. tablet, smartphone);
- A tangible user interface is a user interface where a person interacts with digital information via the physical environment. E.g. ITheatre (enables interactions via tangible physical objects, magnetic cards), Xbox Kinect (input device with motion sensor).

The analysis sheet concludes with an examination of the applications and programmes used by the children and teachers to create the digital artefacts (Table 16).

Table 16 – Software used.

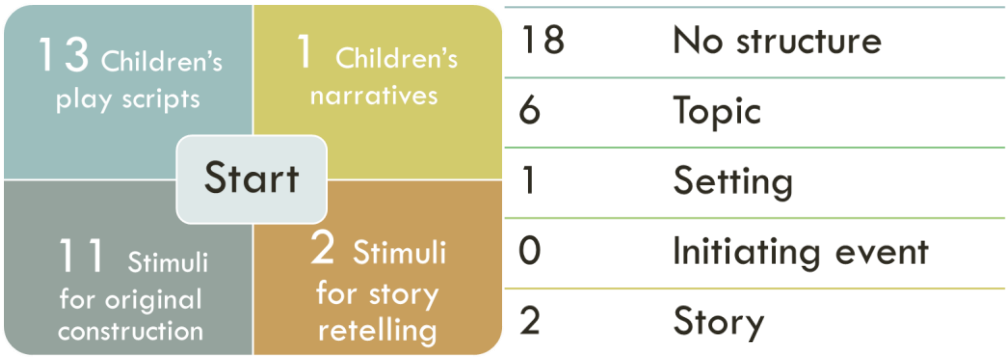
Please list off/online software applications employed by the children to perform any task related to the project.
Please list off/online software applications employed by the teacher(s) to perform any task related to the project.

3. Conclusion

The digital story analysis instrument was used by the STORIES research group to analyse the 174 products of children from the 4 countries involved in the European project. In this paper, it is not possible to go into all the data and findings collected during the two years of activity of the STORIES project (we refer to the project website digitalstorytelling.eu) and the various instruments used in the research. However, to give an example of the type of analysis that could be applied, we would like to briefly discuss a few aspects of the data collected from the Italian sample during the first year of the project. 27 digital stories (together with accompanying material) were collected in 6 kindergartens, where the DST projects were carried out with 24 teachers and 152 children (aged

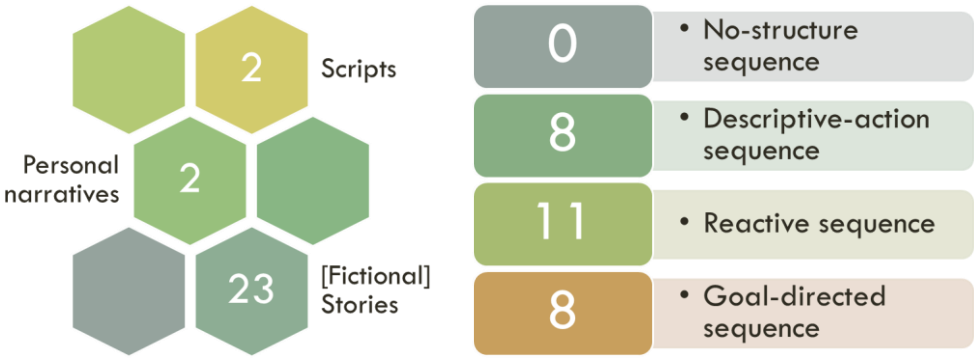
around 4 years). In the six Italian schools, all located in the province of Reggio Emilia and managed by a local authority (Azienda Servizi Bassa Reggiana), digital storytelling was integrated into the context of broader school or class projects dealing with narrative languages. The technical tools were explored by the children before being used productively. Each digital story was analysed by at least two researchers using the analysis protocol described above in order to increase the reliability of the analysis. An interesting aspect of the Italian teachers' planning concerns the choice of the narrative incipit, i.e. the stimulus from which the story is built up. In only two cases were the children offered a story to retell; in eleven cases the teacher offered an open stimulus (a theme, a character) to develop an original construction; in thirteen cases the starting point was a play script provided by the children; in one case it was their own spontaneous narration. The narrative structure originally offered to the children thus consisted in two cases of a complete episode, in one case of the setting and the main character, in six cases of the theme, while in eighteen out of twenty-seven cases no element of the narrative structure was given. Therefore, the amount of narrative structure initially offered to the children was minimal (Figure 4).

Figure 4 – Story starting point and amount of structure provided.



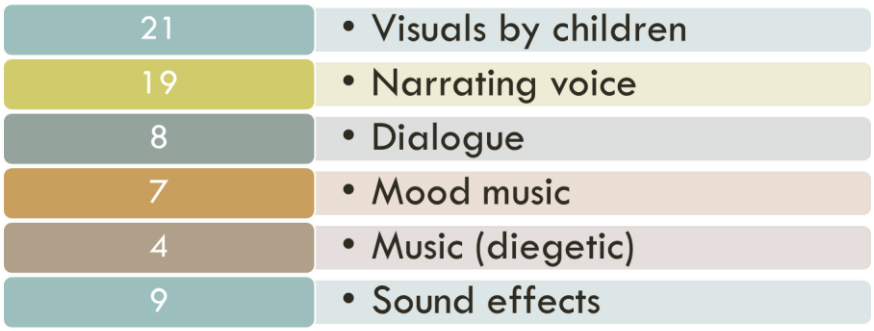
Despite the low grade of narrative structure provided, 4 years old children developed quite “well-formed” stories, as for their developmental stage (Figure 5).

Figure 5 – Story type and story structure category.



The twenty-seven stories observed can be divided into three product categories: ten still image sequences (slideshows with illustrations and photos); seven animations (of the slideshow with animation or screencast type); ten films (moving images taken from life). In some cases there is a mixture, so that a prevalence has been established. In almost all cases, the stories contain drawings, photographs or videos created by the children, as well as the sound of their voices narrating, reciting dialogue or producing sound effects; in some cases, the children also created original music for their story. Overall, then, the stories had visual and audio elements embedded by the children, emphasising the affordances and opportunities of different digital tools for multimodal storytelling.

Figure 6 – Media elements.



The choice of technological aids primarily reflected the current availability of the schools. In twenty-two cases a graphical user interface was used, i.e. a PC; in two cases a tablet (touch interface) was used; in three cases an i-Theatre was used, a specialised tool for children's digital storytelling that integrates a touch screen, buttons and an interface based on tangible objects. Only rarely were stories produced using a single tool. In most cases, the computer was used together with other devices such as a photo/video camera, a projector, an audio recorder and a scanner. Different recording tools were often used to incorporate the visual and audio elements produced by the children. The projector was used both as a monitor to show the recorded or edited content and to create immersive environments in which the narrative was constructed. The use of tools and programmes by the children and teachers varied in the production and post-production phases of the digital stories. In some cases, the children played an active and autonomous role in each phase; in other cases, they produced the visual content independently (drawings, photos, video footage) and then collaborated in the editing and revision under the teacher's guidance; in some cases, the editing was carried out by the teacher. In general, the children were more active in the content creation phase than in the post-production phase. However, it was found that through the guided use of simple, non-professional application programmes, the children were able to recognise the two basic components of audiovisual language, the image and the sound (voice, music, noises and effects), i.e. they recognised that the artefact contains a visual and a verbal/audio component (auditory channel) that overlap along the time axis.

To summarise, the instrument appears to be sufficiently comprehensive, clearly formulated and capable of assessing the quality of digital stories. However, it is emphasised that it is not intended to be used on its own. Rather, it

is necessary to complement the analysis of the digital stories with a variety of information (especially the project plans and the teachers' reports) about the processes that accompanied and supported their invention and construction. Importantly at this point, the full publication of the research instruments and results provides the opportunity to replicate the procedures in other contexts in order to obtain comparable research data.

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