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Evaluating the creative potential of digital storytelling APPs for Primary Education

Evaluación de la potencialidad creativa de aplicaciones móviles creadoras de relatos digitales para Educación Primaria

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Abstract

This study evaluates the creative potential of different apps (N=20) oriented to the de-sign of digital storytelling (DST), directed to users from 6 to 12 years, using the CREAPP K6-12 instrument, made of 48 indicators related to the 5 dimensions of creativity: flexibility, originality, fluency, product elaboration and problem solving, co-edition and dissemination. After adopting descriptive and multivariate statistical techniques, the results show that 76.6% of these apps have great flexibility, 73.4% favor originality, 72.4% present resources and function-alities endowing them with great fluency, 68.3% encourage the creation of creative products, 56.5% promote the resolution of problems, yet only 36.3% prevail the co-edition and dissemination of stories in networks. The correlations show that the most flexible app stimulates originality and fluency, propitiates problem solving and promotes the elaboration of creative products. The index of creative potentiality of the apps is calculated, establishing a competitiveness ranking, which offers keys to the Primary teachers to elaborate didactic proposals that promote creativity through the design of DST.

Resumen

La investigación evalúa la potencialidad creativa de una muestra de aplicaciones móviles (N=20) orientadas al diseño de relatos digitales, para usuarios de 6 a 12 años, utilizando el instrumento CREAPP K6-12, integrado por 48 indicadores relativos a 5 dimensiones de la creatividad: flexibilidad, originalidad, fluidez, elaboración de productos y resolución de problemas, co-edición y difusión. Se adoptan técnicas estadísticas descriptivas y multivariantes. Los resultados muestran que el 76.6% posee gran flexibilidad, el 73.4% favorece la originalidad, el 72.4% presenta recursos y funcionalidades dotándolas de fluidez, el 68.3% fomenta la elaboración de productos creativos, el 56.5% promueve la resolución de problemas, y solo un 36.3% prima la co-edición y difusión de relatos en redes. Las correlaciones entre dimensiones evidencian que las aplicaciones móviles creadoras de relatos digitales más flexibles, estimulan la originalidad, la fluidez, propician la resolución de problemas y promueven la elaboración de productos creativos. Se calcula el índice de potencialidad creativa de las aplicaciones móviles para cada dimensión, estableciendo un *ranking* de competitividad. Finalmente, se ofrece al profesorado de Educación Primaria claves para elaborar propuestas didácticas que impulsan la creatividad a través del diseño de relatos digitales.

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Introduction

The individual's creative dimension is linked to their capacity for initiative, entrepreneurship and spirit of innovation, as well as to the imagination required to express their own ideas and feelings through command of the language under different forms (European Commission, 2006). This involves promoting multiple literacies from school, which enable them to decode and create their own messages, by using several tools and referring to a series of codes (oral, written, digital, etc.). In this sense, initial training of Primary Education teachers should be aimed at developing competences that promote new literacies to build knowledge in the classrooms and at promoting the students' participation and encouraging innovation and creativity (Rodríguez-Martínez & Díez, 2014).

Creativity is thus seen as the intellectual ability involving the development of more complex mental processes, which can be boosted within a formal framework (Palomares & García, 2017), and requiring the support of educational institutions to consolidate (Maley & Kiss, 2018). More specifically, Primary Education is considered as an especially sensitive period to boost creativity (Kharkhurin, 2015; Romo, Alfonso & Sánchez, 2016), when it is essential to offer students innovative creative experiences, as they will contribute to strengthen their creativity as adults (Kucirkova, Littleton & Cremin, 2017).

The school is obviously an optimal context to boost creativity (Judkins, 2016; Robinson & Aronica, 2016), and the teacher's role is essential to face it in a systematised way on the basis of active methodologies (García & Basilotta, 2017; Kettler, Lamb, Willerson & Mullet, 2018) and transversal training practices that lead to the convergence of different areas of the curriculum. Additionally, the selection of didactic resources -to the extent that they stimulate creativity- is a key aspect, as they can increase motivation (Rojas & Fernández, 2018), making the individual analyse and transform their reality, seeking a qualitative improvement (Judkings, 2016) while more active and participative ways of learning are generated (Taja, Tej & Sirkova, 2015).

In this sense, the selection criteria of the digital resources should prioritise the development of each one of the spheres of creativity, fostering flexibility, originality, fluency and being aimed at troubleshooting and creating creative products (Del-Moral, Villalustre & Neira, 2018; Marsh *et al.*, 2015; Rius, 2016). They should also promote interaction and collaborative work to work out creative joint proposals among students, encouraging the educational use of Information and Communication Technologies (TICs) (Gairín & Mercader, 2018). Therefore, the use of digital applications (apps) is considered an optimal strategy that promotes the immersion of students in the digital world (Sanz & García, 2014), and implicitly activates multiple skills (Leinonen, Keune, Veermans & Toikkanen, 2016). For example, the use of digital stories in the classroom can help the student to distinguish reality from fantasy, although teachers need to be provided with basic digital competences (Pérez & Rodríguez, 2016), gradually incorporating technological tools of didactic interest (Tejada & Pozos, 2018).

Digital storytelling using playful apps in Primary Education

Digital storytelling (DST) supported by a series of technological tools is becoming a widespread training practice in a great number of schools, promoting studies that highlight their potential to develop different competences and skills, such as the communicative and digital ones (Cortés, Méndez & Lacasa, 2016; Ibarra & Ballester, 2016; Robin, 2016); the narrative, socio-emotional and creative ones (Del-Moral, Villalustre & Neira, 2016, 2018); the communicative competence linked to foreign language teaching (Carrasco, Baldivieso & Di Lorenzo, 2016); and conflict-resolution skills (Castro, Olarte & Corredor, 2016), etc.

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This narrative practice is obviously becoming a didactic strategy -of a transversal nature- in which a series of areas of the Primary Education curriculum are involved and which can encourage new digital readers-writers (Dezuanni, Dooley, Gattenhof & Knight; 2015 Hernández, 2017). It is also being promoted simultaneously with the emergence of specific applications (apps) aimed at DST generation, which are activated through mobile devices and integrate tools that combine different languages (audio-visual, musical, textual, oral, cinema, etc.) to tell stories and allow for reading-writing skills to be developed (Gómez-Díaz, García-Rodríguez & Cordón-García, 2015).

Such stories can be designed through video editing, stop-motion animations, photomontage using graphic elements, comic (Gasek, 2017), etc., and jointly boost expressive, communicative, digital and artistic skills. Some apps offer the opportunity to create professional stories (artistic representations, branding, etc.) and have different objectives: poetic, to entertain the audience; factual, to have followers and maintain their interest; conative, to influence them, etc. (Althuizen, Wierenga & Chen, 2016; Walter, Gioglio & Roam, 2014).

In this study, we selected DST apps of a playful nature aimed at children and youngsters, with an attractive interface, colourful settings, a wide range of characters, where texts can be edited and/or voice-overs can be used to accompany pictures or illustrations, describe represented actions or create dialogues, developing alternative plots, etc. This is based on the fact that we believe that they can activate creative capacity, develop basic competences and become innovating tools that promote reading and writing in Primary Education (Bustos, Montenegro, Tapia & Calfual, 2017).

Contributions made by DST apps to Primary Education

By using DST apps, students are introduced to the creative process of creating and structuring stories, as they help to identify turning points and the plot climax that characterise stories (Shelton, Archambault & Hale, 2017), and to identify each part thereof (setup, confrontation and resolution). The guidelines provided by the apps help them assimilate the story's basic structure and give internal coherence thereto. They promote the acquisition of spatial-temporal concepts when creating plots and stories, establishing relations among the various characters, describing their actions and motivations, designing settings (Ellis & Brewster, 2014), and when solving any trouble that may emerge as action takes place.

This narrative activity supported by apps involves the use of oral and written or graphic language to translate their ideas and/or real or fictitious experiences, and stimulates linguistic communication as it promotes the use of a richer vocabulary, the suitable incorporation of connectors and causal elements and the adoption of coherent dialogue structures (Cooper, 2016; Engen, Giæver & Mifsud, 2014). It helps to strengthen graphic language at the same time, fostering the aesthetic ability as it invites students to place their stories in specific settings, to provide them with colour, to add music or onomatopoeiae to them, as well as to provide movement and expressiveness to the characters, change their costume, reflect their emotional state, modulate and change intonation, etc.

These apps also stimulate fluency of ideas (Rojas & Tyler, 2018) and critical and divergent thinking, which is necessary to promote creative thinking (Runco, 2017) through interaction of disparate elements. They also promote the development of originality and stimulate the students' imagination and curiosity as they can contribute with new ideas (Del-Corte, Molina & Vallet, 2016), and offer them the opportunity to resolve the plot in an unsuspected way. They are also invited to meet the challenges posed during the narrative process to adopt alternative twists or approaches and to devise solutions to solve any technical or otherwise problems that may arise (Sternberg & Kaufmann, 2018).

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On the other hand, continuous feedback provided by these apps enhances motivation and immersion in the storytelling activity, as the appropriateness of those decisions made is highlighted. Some of them allow creating collaborative stories, promoting socio-emotional interaction on the basis of consensual decision-making by means of the students' different approaches. Another motivating feature inherent to these activities is the adoption of gamified strategies, linked to celebrating success at the end of each story, and the award of points or another bonus system to enhance and strengthen the completed activities. Some of them offer the opportunity to share and view the final product through online publication on specific platforms, open social media, etc. All these features definitely boost their functionality, although they do not always activate creativity to the same extent.

Therefore, the objective of this research is to evaluate the creative potential of a sample of DST apps aimed at users aged between 6 and 12, free and accessible online, considering 48 indicators linked to the dimensions that define creativity, to provide primary education teachers with a set of useful teaching tools to implement them in their classrooms, in order to promote the learning of reading and writing

Method

Methodology

The methodology used is of a quantitative nature, supported by descriptive and multivariate statistical techniques (bivariate relations and factor analysis). More specifically, the results obtained from the expert evaluation of an app sample (N=20) -focused on DST- were presented, considering six dimensions closely linked to the creativity promoted by digital storytelling designed, performed through a series of codifiers (N=3). The CREAPP K6-12 (Del-Moral, Bellver & Guzmán, 2018) instrument was used, validated through Cohen's Kappa, being k=.897 (p<.000),

which is highly reliable as K>.7. Statistical processing was performed through SPSS version 24 software.

Once data were standardised, the creativity empowerment index of the app selected was calculated, and the scores obtained in each dimension were added to determine the total cumulated score, considering the values included between Q2-Q3, evidencing that such data are within normal parameters (García & Pulido, 2015). This allowed the creation of a competitiveness ranking to identify the apps that promote creativity to a greater extent. The values used to perform this analysis are based on the apps's expert evaluation.

Sample

We selected a sample of 20 apps that met the requirements of being DST-oriented, aimed at users aged between 6 and 12, free and accessible online. Table 1 shows the identification data: name, company, last updated (year), operating system(s) (ios, android, windows, chrome, kindle, etc.), language(s), target age, use (online/offline) and URL.

Instrument

The validated instrument used to evaluate the each app's creative potential is CREAPP K6-12 (Del-Moral, Bellver & Guzmán, 2018), where the six dimensions that contribute to define their status as a creative tool linked to storytelling were considered: flexibility, originality, fluency, troubleshooting, product elaboration, coediting and dissemination. It is made up of 48 indicators, measured using a Likert-type scale (1=none, 2=a little, 3=quite, 4=very much), except for those related to the coediting and diffusion dimensions, as they are dichotomous (yes/no).

Procedure

Once the sample was selected, the expert evaluation process was performed using three

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Table 1.

Sample of the DST apps evaluated

Evaluated apps	Descriptive data: System. Language(s). (Age). Use. URL
1. Book Creator. Red Jumper (2017)	IOS, Chrome. English. (6-10 years). *Online.* (https://bit.ly/2ry7GhX)
2. Com-Phone StoryMaker. Softland (2017)	Android. English. (10-12). *Online.* https://bit.ly/2EBlqhi)
3. Creappcuentos Proyecto VíaVigo (2013)	Android, IOS. Spanish. (+9). *Online.* (https://bit.ly/2lHIty2)
4. Cuentos locos. Movimiento Maresme.	*Laptop*, Android, Firefox OS. Spanish. (5-8). *Offline-online.* (https://bit.ly/2tSXroI)
5. Easy Studio. Edoki Academy (2017)	IOS. Spanish, English, other. (6-8). *Offline-online.* (https://apple.co/2VDN4RB)
6. Hipercuentos. Movimiento Maresme.	Windows. Spanish. (6-12). *Online.* (https://bit.ly/2EQK0vK)
7. Imagistory (2014)	IOS. Spanish. (+4). *Offline-online.* (https://bit.ly/2ESzlRp)
8. Infiniscroll. Curious Ha (2013)	IOS. English. (6-8). *Online.* (https://apple.co/2H3WkeI)
9. Máquina de historias. Maguare (2017)	Windows. Spanish. (6-8). *Online.* (https://bit.ly/2HhRHwP)
10. Movenote (2015)	Chrome. English. (6-12). *Online.* (https://bit.ly/2UoEENI)
11. Sock Puppets. SmithMicro Soft (2016)	IOS. English. (+4). *Online.* (https://apple.co/2EIIRp8)
12. Storybird (2017)	Chrome. English. (6-12). *Online.* (https://bit.ly/1jqTqOw)
13. Story Board That. Clever Prototypes (2014)	*Laptop*, Android devices, Firefox OS. Spanish-English (6-12). *Offline-online.* (https://bit.ly/1ghxn96)
14. Storytelling with Maps. ESRI (2017)	Windows. English and Spanish (6-12). *Online.* (https://bit.ly/25zcwdZ)
15. Telestory. Apple (2015)	IOS. English. (+6). *Online.* (https://apple.co/2GZWbsw)
16. Toca Life Town. Toca Boca (2015)	IOS. English. (+4). *Offline-online.* (https://apple.co/2XHiYP2)
17. Toontastic Google (2017)	IOS, Android, Windows. English. (6-12). *Offline-online.* (https://bit.ly/2jKDEVL)
18. Thinglink (2016)	IOS. Android. English. (6-12). *Online.* (https://bit.ly/1dMrJ0i)
19. WiVideo (2017)	Windows. English. (10-12). *Online.* (https://bit.ly/2fcdcRo)
20. Word Tamer. Judywaite (2014)	Windows. English. (6-12). *Online.* (https://bit.ly/1iTioWH)

Source: Prepared by the authors.

codifiers, who tested each one the apps selected to evaluate both their technical aspects, related to accessibility, tutorials, the functionality of the tools and digital resources included to create stories, feedback mechanisms, etc.; as well as their adaptation capabilities at the various levels of potential users, the degree of freedom for such users to translate their ideas and include their own elements (texts, pictures, audio, etc.); their versatility to generate different types of personal or literary studies (chronicles, stories, tales, legends, poetry, etc.); as well as the opportunity offered to include cross-language elements, to develop alternative plots, etc.

A descriptive statistical analysis was then performed, using multivariate techniques: factor analysis to detect what indicators contribute to boost each dimension to a greater extent; and bivariate correlations to determine the link between dimensions. In last place, the creativity empowerment index of the apps under analysis was calculated, whereby a competitiveness ranking was established to identify those apps that boost creativity to a greater extent.

Results

Creative potential of the apps considering each dimension

Table 2 shows the expert evaluation of the sample of the apps selected concerning the level of flexibility development offered. It is found that they globally contribute pretty or very much to enhance it thanks to the activities and

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Table 2.

Flexibility degree (FD) of the apps under analysis

1. FD dimension	None	Little	Quite	Very much	M	SD
1.1. Environment is accessible (story workshop)	.0	8.0	36.0	56.0	3.48	.646
1.2. Adapted to different levels of difficulty	14.0	6.0	22.0	58.0	3.24	1.080
1.3. Includes a range of codes (verbal, iconic, sound, etc.)	10.0	20.0	14.0	56.0	3.16	1.076
1.4. Allows to handle and exchange elements	12.0	26.0	10.0	52.0	3.02	1.134
1.5. Makes interrelation of disparate elements possible	24.0	6.0	26.0	44.0	2.9	1.216
1.6. Gives freedom to build different types of stories	20.0	14.0	22.0	44.0	2.9	1.182
1.7. Offers the opportunity to modify and reformulate the story	20.0	18.0	22.0	40.0	2.82	1.173
1.8. Stimulates critical or divergent thinking	16.0	12.0	24.0	48.0	3.04	1.124

Source: Prepared by the authors.

resources it integrates, as it can be seen in most indicators defining this dimension of creativity. Particularly, with regard to the accessibility of the playful environment (92%), the capacity to adapt to each user's level (80%), the range of codes included (70%) and the opportunity to handle and exchange elements (62%). Although 38% do not allow or hardly allow to modify or reformulate the initial text, 34% give little or no freedom to decide what type of story is to be created due to their scarce resource, and 30% make possible to a very little or no extent the interrelation of disparate elements, as they have pre-set settings and characters.

Table 3 shows that 84% of the apps contribute pretty or very much to promote the representation of unexpected events in the stories, 82% arouse curiosity and inquiry, 80% involve the user in the creation of emotional plots, 74% enhance the development of innovative proposals, and 68% activate imagination to design one's own elements. Nevertheless, 58% do not offer a wide range of characters and settings, limiting their potential, and 38% do not promote the resolution of plots in an unexpected way.

Table 4 shows that 76% promote pretty or very much the individual's immersion when creating the story. Similarly, 74% make it possible to

Table 3.

Originality degree (OD) of the apps under analysis

2. OD dimension	None	Little	Quite	Very much	M	SD
2.1. Arouses curiosity and inquiry	.0	18.0	22.0	60.0	3.4	.785
2.2. Has galleries with characters, settings, audio, etc.	26.0	32.0	12.0	30.0	2.5	1.182
2.3. Activates imagination to design one's own elements	18.0	14.0	24.0	44.0	2.9	1.150
2.4. Encourages representation of unexpected events	14.0	12.0	28.0	46.0	3.1	1.077
2.5. Offers open answers far from the action-reaction principle	20.0	12.0	38.0	30.0	2.8	1.093
2.6. Enhances development of innovative proposals	12.0	14.0	24.0	50.0	3.1	1.062
2.7. Promotes creation of emotional plots	18.0	2.0	46.0	34.0	3.0	1.049
2.8. Promotes resolution of plots in an unexpected way	12.0	26.0	28.0	34.0	2.8	1.037

Source: Prepared by the authors.

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Table 4.

Fluency degree (FUD) of the apps under analysis

3. FUD dimension	None	Little	Quite	Very much	M	SD
3.1. Promotes spontaneous evocation of stories	18.0	12.0	18.0	52.0	3.0	1.177
3.2. Offers varied formulas to represent unprecedented ideas	18.0	24.0	22.0	36.0	2.8	1.135
3.3. Ensures non-sequential stories are created	20.0	18.0	40.0	22.0	2.6	1.045
3.4. Makes it possible to explore the versatility of the resources integrated	16.0	10.0	22.0	52.0	3.1	1.129
3.5. Stimulates the classification of disparate elements	12.0	36.0	6.0	46.0	2.9	1.143
3.6. Allows to incorporate external texts, pictures, audio	14.0	20.0	24.0	42.0	2.9	1.096
3.7. Promotes alternative narrative plots	18.0	48.0	6.0	28.0	2.4	1.091
3.8. Activates immersion when creating the story	10.0	14.0	26.0	50.0	3.2	1.017

Source: Prepared by the authors.

explore the versatility of the resources integrated, 70% promote spontaneous evocation of stories, and 66% allow to incorporate external texts, pictures, audio, etc., although 66% do not or hardly promote alternative narrative plots, and also 48% do not stimulate the classification of disparate elements, limiting divergent thinking.

Table 5 shows that 76% of the apps contribute pretty or very much to pose technical challenges of problems that need to be solved, and make it possible to analyse the range of variables involved when creating the story to the same extent. 70% include elements to view the progress, and 64% accept several approaches to execute it. Although 78% hardly offer the user feedback about the suitability of actions, they do not celebrate or reinforce success at the end of the final story. Simultaneously, 46% do not have any tutorial.

Table 6 shows that 78% foster pretty or very much aesthetic and artistic sensitivity; similarly, 72% promote the construction of divergent, non-stereotyped stories to a great extent. 68% enhance digital literacy by incorporating a series of tools and techniques, 56% consider elements from different narrative genres, and 52% combine cross-language expressive

Table 5.

Troubleshooting degree (TSD) of the apps under analysis

4. TSD Dimension	None	Little	Quite	Very much	M	SD
4.1. Offers tutorial or help for users	4.0	42.0	24.0	30.0	2.80	.926
4.2. Poses technical challenges or problems to solve	14.0	10.0	32.0	44.0	3.06	1.058
4.3. Accepts several approached to execute actions	14.0	22.0	22.0	42.0	2.92	1.104
4.4. Makes it possible to analyse variables when creating stories	14.0	10.0	38.0	38.0	3.00	1.030
4.5. Allows to apply made-up solutions	16.0	16.0	32.0	36.0	2.88	1.081
4.6. Includes elements to view the progress	8.0	22.0	24.0	46.0	3.08	1.007
4.7. Offers feedback about the suitability of actions	52.0	26.0	16.0	6.0	1.76	.938
4.8. Celebrates or reinforces success at the end of the final story	60.0	18.0	18.0	4.0	1.66	.917

Source: Prepared by the authors.

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Table 6.

Product elaboration degree (PED) of the apps under analysis

5. PED Dimension	None	Little	Quite	Very much	M	SD
5.1. Stimulates the construction of divergent, non-stereotyped stories	12.0	16.0	20.0	52.0	3.1	1.081
5.2. Provides a granular structure to the story	24.0	28.0	16.0	32.0	2.6	1.181
5.3. Combines cross-language expressive resources (oral, written, musical, visual)	16.0	32.0	16.0	36.0	2.7	1.126
5.4. Edits stories in various formats (text, cartoons, comics, animation, video)	24.0	64.0	6.0	6.0	1.9	.740
5.5. Promotes design of resources or one's objects (characters, settings, sounds, soundtrack)	20.0	40.0	6.0	34.0	2.5	1.164
5.6. Considers elements from different narrative genres	16.0	28.0	28.0	28.0	2.7	1.058
5.7. Enhances digital literacy by incorporating a series of tools and techniques	16.0	18.0	14.0	52.0	3.0	1.169
5.8. Evidences aesthetic and artistic sensitivity	20.0	2.0	28.0	50.0	3.1	1.158

Source: Prepared by the authors.

resources (oral, written, musical, visual...). Nevertheless, 88% of these apps do not allow the user to edit stories in various formats (text, cartoons, comics, animation, video...), and hardly 52% even provide a granular structure to the story.

Finally, given the dichotomous nature of the coediting and dissemination dimensions (table 7), it is worth noting that most apps (88%) allow to identify the author of the stories, 84% promote cross-language interaction, and 72% allow story reuse. 58% have a user community to interact and 56% promote collaborative editing. Despite of certain limitations, 30% facilitate the dissemination of stories in social media, 28% include communication tools, and hardly 25% make it possible to disseminate stories in open platforms.

Features of the apps that boost creativity: key indicators of each dimension

On performing the factor analysis, several indicators that contribute to determine what features boost creativity to a greater extent were

Table 7.

Opportunity to coedit and disseminate (CDD) offered by the apps under analysis

6. CDD Dimension	YES	NO
6.1. Promotes collaborative edition of stories	56.0	44.0
6.2. Integrates tools for group communication and planning	28.0	72.0
6.3. Identifies the authors of the stories	88.0	12.0
6.4. Allows story reuse	72.0	28.0
6.5. Publishes final stories in open platforms	26.0	74.0
6.6. Invites users to share stories in the social media	30.0	70.0
6.7. Has a user community to exchange experiences and resources	58.0	42.0
6.8. Promotes cross-language interaction	84.0	16.0

Source: Prepared by the authors.

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identified. More specifically, features related to flexibility highlighting the potential of apps to develop creativity are linked to the indicators: (1.3) a range of codes (verbal, iconic, sound, etc.) is included; (1.4) allows to handle and exchange elements; (1.5) makes interrelation of disparate elements possible; (1.6) gives freedom to build different types of stories; (1.7) makes it possible to modify and remodulate the story; and (1.8) stimulates critical or divergent thinking, (KMO=.862; Barlett's test of sphericity=391.364, gl=15, $p<.000$, VE=85.422).

Likewise, as far as originality is concerned, almost all indicators are highlighted: (2.1) arouses curiosity and inquiry; (2.3) activates imagination; (2.4) encourages representation of unexpected events; (2.5) offers open answers; (2.6) promotes development of innovative proposals; (2.7) promotes creation of emotional plots; y, (2.8) promotes resolution of plots in an unexpected way, (KMO=.879; Barlett's sphericity test =285.303, gl=21, $p<.000$, VE=70.708). As far as fluency is concerned, all of them are key indicators (KMO=.859; Bartlett's sphericity test=429.695, gl=28, $p<.000$, VE=75.292).

As far as the TSD dimension is concerned, the most relevant indicators are: (4.2) poses challenges; (4.3) accepts several approaches; (4.4) makes it possible to analyse variables when creating stories; (4.5) allows to apply made-up solutions; and (4.6) allows to view the progress, (KMO=.740; Bartlett's sphericity test=313.441, gl=19, $p<.000$, VE=84.077). On their part, concerning product elaboration, the following indicators are worth noting: (5.1) stimulates the construction of divergent, non-stereotyped stories; (5.2) provides a granular structure to the story; (5.3) combines cross-language expressive resources; (5.7) enhances digital literacy; (5.8) evidences aesthetic and artistic sensitivity, (KMO=.831; Bartlett's sphericity test=187.825, gl=10, $p<.000$, VE=76.136).

However, as far as CDD dimension is concerned, only the following indicators are worth noting: (6.2) integrates tools for group communication and planning; (6.5) publishes stories in open platforms; (6.6) invites users to share stories in the social media, (KMO=.736; Bartlett's sphericity test=106.494, gl=3, $p<.000$, VE=80.696).

As for bivariate correlations, it was found that there are significant relations between the following dimensions: a) flexibility with originality ($r=.918$, $p<.000$), with fluency ($r=.916$, $p<.000$), with troubleshooting ($r=.881$, $p<.000$) and with product elaboration ($r=.928$, $p<.000$); b) originality with fluency ($r=.920$, $p<.000$), with troubleshooting ($r=.922$, $p<.000$), and with product elaboration ($r=.936$, $p<.000$); c) fluency with troubleshooting ($r=.974$, $p<.000$) and with product elaboration ($r=.940$, $p<.000$); and, d) troubleshooting with product elaboration ($r=.933$, $p<.000$). It is worth noting that CDD dimension is not correlated to any other dimension. It can thus be stated that the most flexible apps simultaneously stimulate originality and fluency, promote troubleshooting and result in the production of creative products.

Creativity ranking related to the apps under analysis

Table 8 shows the ranking of the DST apps under analysis that potentially boost creativity to a greater extent. It is found that they largely flexibility (76.6%), originality (73.4%) and fluency (72.4%).

The five top apps are the following: *Thinkling* (83.1%), *Story Board That* (82.3%), *Easy Studio* (81%), *Com-Phone Story Maker* (79.7%) and *Wivideo* (79.4%). Each one has certain specific features that endow them with their own identity. More specifically, *Thinkling* promotes the creation of video projects using various tools, even pictures in 360º. It offers great levels of flexibility and originality, it allows open editing and sharing videos in different platforms and social media. On its part, *Story Board That* has a wide range of settings (home, school, occupations, outdoor spaces...) where the characters can be located, it includes tools to edit scenes and offer the oppor-

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Table 8.
Ranking of those apps that promote creativity to a greater extent

App ranking	Dimensions linked to creativity that are boosted to a greater extent (%)						Average %
	FD	OD	FUD	TSD	PED	CDD	
1. Thinglink	100.0	85.9	100.0	81.3	100.0	31.3	83.1
2. Story Board That	96.9	100.0	95.3	84.4	82.8	34.4	82.3
3. Easy Studio	96.9	87.5	89.1	87.5	84.4	40.6	81.0
4. Com-Phone Story Maker	93.8	85.9	100.0	79.7	93.8	25.0	79.7
5. Wivideo	93.8	85.9	100.0	78.1	93.8	25.0	79.4
6. Storytelling with Maps	100.0	81.3	100.0	81.3	81.3	25.0	78.1
7. Telestory	92.2	93.8	87.5	68.8	90.6	34.4	77.9
8. Creappcuentos	87.5	84.4	76.6	79.7	75.0	40.6	74.0
9. Sock Puppets	78.1	84.4	71.9	79.7	75.0	37.5	71.1
10. Book Creator	87.5	89.1	82.8	68.8	62.5	31.3	70.3
11. Toontastic	76.6	84.4	75.0	75.0	67.2	37.5	69.3
12. Toca Town	78.1	78.1	68.8	84.4	65.6	39.1	69.0
13. Infiniscroll	70.3	73.4	71.9	68.8	71.9	37.5	65.6
14. Movenote	96.9	76.6	62.5	48.4	82.8	25.0	65.4
15. Word Tamer	75.0	68.8	56.3	59.4	56.3	40.6	59.4
16. Storybird	57.8	56.3	60.9	56.3	57.8	31.3	53.4
17. Imagistory	51.6	57.8	50.0	45.3	46.9	45.3	49.5
18. Máquina de cuentos	39.1	34.4	26.6	32.8	28.1	50.0	35.2
19. Cuentos locos	29.7	29.7	28.1	31.3	25.0	46.9	31.8
20. Hipercuentos	31.3	29.7	25.0	31.3	25.0	46.9	31.5
Average %	76.6	73.4	71.4	66.1	68.3	36.3	

Source: Prepared by the authors.

tunity to create cartoons to insert and reproduce dialogues, records in different formats and includes templates to write texts. It allows to insert pictures, images and audio to customise the story and share it.

Easy Studio creates stop-motion stories, includes multiple shapes, colours and templates to create animations. *Com-Phone Story Maker* creates stories using pictures, audio and texts. It presents slides and music can be added (up to three tracks) thereto, as well as pictures, etc. Recordings can be stopped and resumed later and templates can be created, as well as sending it to other devices and upload them to the social media. *Wivideo* is a platform that enables collaborative editing of *online* videos, inserting images, pictures, music, recordings, etc. that can be shared and edited openly.

In a nutshell, Primary Education teachers can decide what tool to use or how to combine them to promote creativity, considering each specific context, obviously.

Conclusions

On the basis of the analysis conducted, it can be stated that in order to boost creativity among students, with the support of DST, it

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is advisable to select those apps that allow to enhance the dimensions inherent to these skills jointly; in other words, those with a greater score in most of their indicators. More specifically, teachers should select those apps that include tutorials in order to leverage all their functionalities and put it at the service of storytelling and that integrate a wide range of digital resources (wide galleries with characters, settings, music, etc.) (Ellis & Brewster, 2014); together with self-design tools to promote digital literacy (Sanz & García, 2014), facilitating the creation of non-stereotyped, divergent stories. It is also interesting that they make it possible to edit stories combining different formats (text, cartoons, animations, videos, etc.), adapt to multiple narrative genres, analyse the variables involved in the creation of stories and consider several elements both to view and revert the storytelling process. It is essential that they pose challenges and invite to resolve different types of problems (technical, argumentative, narrative, etc.) (Kaufmann, 2018), as they foster aesthetic and artistic sensitivity.

It is obvious that the integration of those apps aimed at enhancing the students' creativity, based on storytelling, should adapt to age and year, combining technical complexity and the opportunities to enhance linguistic and digital skills (variety of languages and narrative genres). Although we highlight five apps that stand out for their creative potential, teachers should analyse their versatility to deal with multi-disciplinary contents, to promote the development of multiple competences and highlight the learning of reading and writing. They should also analyse their adaptive capacity to combine them, to integrate them in active methodologies -such as project-based learning- using their potential to build collaborative or personal stories that reflect their evolution. Alternatively, this can also be done highlighting the functional use of language, activating socio-emotional skills by facilitating interaction among peers during the collaborative creative process, highlighting their expressive capacity.

The integration of these apps in the classrooms is very recent and requires thorough studies to determine their advantages and should not imply waiver of other conventional storytelling practices. To that end, it is essential to set guidelines for evaluation, for example, based on analytical rubrics that allow to verify successful reading outcomes -in terms of acquired or developed competences- derived from the use of these tools. In this sense, new applications are emerging, which register -through learning analytics- the progress made by users (Ebner & Schön, 2013), identifying their strengths and weaknesses, and allowing for the creation of a plan of interventions of an adaptive nature.

Finally, we have included the indicators that should be taken into account by app designers in order for their products to boost the creativity of their target users, notably promoting coediting of stories and their dissemination in open social media, showing them as forms of communication and expression that integrate multiple language, stimulate both originality and storytelling fluency and promote troubleshooting.

References

Althuizen, N., Wierenga, B., & Chen, B. (2016). Managerial decision-making in marketing: Matching the demand and supply side of creativity. *Journal of Marketing Behavior*, 2(2-3), 129-176. doi: https://doi.org/10.1561/107.00000033.

Bustos, A., Montenegro, C., Tapia, A., & Calfual, K. (2017). Leer para aprender: cómo interactúan los profesores con sus alumnos en la educación primaria. *Ocnos,* 16(1), 89-106. doi: https://doi.org/10.18239/ocnos_2017.16.1.1208.

Carrasco, S., Baldivieso, S., & Di-Lorenzo, L. (2016). Formación en investigación educativa en la sociedad digital. Una experiencia innovadora de enseñanza en el nivel superior en el contexto latinoamericano. *RED. Revista de Educación a Distancia*, 6(48), 1-19. doi: https://doi.org/10.6018/red/48/6.

Castro, D., Olarte, F., & Corredor, J. (2016). Tecnología para la comunicación y la solución de problemas

Ocnos (2019), 18 (1): 7-20
DOI 10.18239/ocnos_2019.18.1.1866

Del-Moral, M. E., Bellver, M. C., &. Guzmán-Duque, A. P.
Evaluating the creative potential of digital storytelling APPs for Primary Education

en el aula: Efectos en el aprendizaje significativo. *Digital Education Review*, 30, 207-219.

Cortés, S., Méndez, L., & Lacasa, P. (2016). Ipads, apps y redes sociales: construyendo narrativas multimodales en las aulas. *Digital Education Review*, 30, 54-75.

Comisión Europea (2006). Recomendación del Parlamento Europeo y del Consejo de 18 de diciembre de 2006 sobre las competencias clave para el aprendizaje permanente. *Diario Oficial de la Unión Europea*, 394, 10-18. Retrieved from https://bit.ly/2C7dunr.

Cooper, M. (2016). Multimodal teaching and learning: researching digital storytelling on iPads in the primary school classroom to develop children's story writing. *Journal of Literacy and Technology*, 17(1/2), 53-79. Retrieved from https://bit.ly/2SQ53lW.

Del-Corte, V., Molina, F., & Vallet, T. (2016). Mediating effect of creativity between breadth of knowledge and innovation. *Technology Analysis & Strategic Management*, 28(7), 768-782. doi: https://doi.org/10.1080/09537325.2016.1142075.

Del-Moral, M.E., Bellver, M.C., & Guzmán, A.P. (2018). CREAPP K6-12: Instrumento para evaluar la potencialidad creativa de app orientadas al diseño de *digital storytelling*. *Digital Education Review*, 33, 284-305.

Del-Moral, M.E., Villalustre, L., & Neira, M.R. (2016). Relatos digitales: activando las competencias comunicativa, narrativa y digital en la formación inicial del profesorado. *Ocnos, 15*, 22-41. doi: https://doi.org/10.18239/ocnos_2016.15.1.923.

Del-Moral, M.E., Villalustre, L., & Neira, M.R. (2018). Percepción docente del desarrollo emocional y creativo de los escolares derivado del diseño colaborativo de digital *storytelling*. *Educación XX1*, 21(1), 345-374. doi: https://doi.org/10.5944/educxx1.20202.

Dezuanni, M., Dooley, K., Gattenhof, S., & Knight, L. (2015). *IPads in the Early Years: Developing Literacy and Creativity*. New York, EEUU: Routledge. doi: https://doi.org/10.4324/9781315771830.

Ebner, M., & Schön, M. (2013). Why learning analytics in primary education matters. *Bulletin of the Technical Committee on Learning Technology*, 15(2), 14-17.

Ellis, G., & Brewster, J. (2014). *Tell it again!: The Storytelling Handbook for Primary English Language Teachers*. London, United Kingdom: British Council.

Engen, B., Giæver, T., & Mifsud, L. (2014). IPads in context: interaction design for schools. In M. Searson, & M. Ochoa (Eds.), *Proceedings of SITE 2014: Society for Information Technology & Teacher Education International Conference* (pp. 1633-1640). Florida, Estados Unidos: Association for the Advancement of Computing in Education (AACE). Retrieved from https://bit.ly/2Unc7bx.

Gairín, J., & Mercader, C. (2018). Usos y abusos de las TIC en los adolescentes. *Revista de Investigación Educativa, 36*(1), 125-140. doi: https://doi.org/10.6018/rie.36.1.284001.

García, J., & Pulido, J. (2015). Creacity, una propuesta de índice para medir la creatividad turística. Aplicación en tres destinos urbano-culturales españoles. *Revista de Estudios Regionales*, 103, 69-108.

García, A., & Basilotta, V. (2017). Aprendizaje Basado en Proyectos (AbP): evaluación desde la perspectiva de alumnos de educación primaria. *Revista de Investigación Educativa, 35*(1), 113-131. doi: https://doi.org/10.6018/rie.35.1.246811.

Gasek, T. (2017). *Frame-by-frame stop motion: the guide to non-puppet photographic animation techniques*. Florida, EEUU: CRC Press, Taylor & Francis Group. doi: https://doi.org/10.1201/9781315155166.

Gómez-Díaz, R., García-Rodríguez, A., & Cordón-García, J.A. (2015). APPrender a leer y escribir: aplicaciones para el aprendizaje de la lecto-escritura. *Education in the Knowledge Society, 16*(4), 118-137. doi: https://doi.org/10.14201/eks2015164118137.

Hernández, A. (2017). Los cuentacuentos: una experiencia innovadora para el fomento de la competencia en comunicación lingüística a través del cuento en alumnos de tercer curso de educación primaria. *MULTIárea. Revista de Didáctica*, 8, 171-193. doi: https://doi.org/10.18239/mard.v0i8.1157.

Ibarra, N., & Ballester, J. (2016). Book tráiler en educación infantil y primaria: adquisición y desarrollo de la competencia comunicativa, digital y literaria a través de narrativas digitales. *Digital Education Review, 30*, 76-93.

Ocnos (2019), 18 (1): 7-20
DOI 10.18239/ocnos_2019.18.1.1866

Del-Moral, M. E., Bellver, M. C., &. Guzmán-Duque, A. P.
Evaluating the creative potential of digital storytelling APPs for Primary Education

Judkins, R. (2016). *The art of creative thinking: 89 ways to see things differently*. New York, EEUU: Perigee Books.

Kaufmann, G. (2018). Beyond big and little: the four C model of creativity. *Review of General Psichology*, *13*(1), 1-12. doi: https://doi.org/10.1037/a0013688.

Kettler, T., Lamb, K., Willerson, A., & Mullet, D. (2018). Teachers' perceptions of creativity in the classroom. *Creativity Research Journal*, *30*(2), 164-171. doi: https://doi.org/10.1080/10400419.2018.1446503.

Kharkhurin, A. (2015). The big question in creativity research: the transcendental source of creativity. *Creativity. Theories–Research-Applications*, *2*(1), 90-96. doi: https://doi.org/10.1515/ctra-2015-0014.

Kucirkova, N., Littleton, K., & Cremin, T. (2017). Young children's reading for pleasure with digital books: six key facets of engagement. *Cambridge Journal of Education*, *47*(1), 67-84. doi: https://doi.org/10.1080/0305764X.2015.1118441.

Leinonen, T., Keune, A., Veermans, M., & Toikkanen, T. (2016). Mobile apps for reflection in learning: a design research in K-12 education. *British Journal of Educational Technology*, *5*(2), 184-202, doi: https://doi.org/10.1111/bjet.12224.

Maley, A., & Kiss, T. (2018). Creativity and education. In A. Maley & T. Kiss, *Creativity and English Language Teaching* (pp. 47-67). London, United Kingdom: Palgrave MacMillan. doi: https://doi.org/10.1057/978-1-137-46729-4_3.

Marsh, J., Plowman, L., Yamada, D., Bishop, J., Lahmar, J., Davenport, A., Davis...Winter, P. (2015). *Exploring play and creativity in pre-schoolers' use of apps: Final Project Report. Technology and Play*. Retrieved from https://bit.ly/2EPTGqC.

Palomares, A., & García, R. (2017). Innovación y creatividad para favorecer la intervención educativa del alumnado con altas capacidades. *Revista de Educación Inclusiva*, *9*(1), 90-100. Retrieved from https://bit.ly/2C8wVw7.

Pérez, A., & Rodríguez, M. (2016). Evaluación de las competencias digitales autopercibidas del profesorado de educación primaria en Castilla y León (España). *Revista de Investigación Educativa*, *34*(2), 399-415. doi: https://doi.org/10.6018/rie.34.2.215121.

Rius, N. (2016). Book tráiler en educación infantil y primaria: adquisición y desarrollo de la competencia comunicativa, digital y literaria a través de narrativas digitales. *Digital Education Review*, *30*, 76-93.

Robin, B. (2016). The power of digital storytelling to support teaching and learning. *Digital Education Review*, *30*, 17-29.

Robinson, K., & Aronica, L. (2016). *Creative Schools: the grassroots revolution that's transforming education*. London, United Kingdom: Penguin Books.

Rodríguez-Martínez, C., & Díez, E. (2014). Conocimiento y competencias básicas en la formación inicial de maestras y maestros. *Profesorado, Revista de Currículum y Formación del Profesorado*, *18*(1), 383-396.

Rojas, I., & Fernández, V. (2018). Relación entre la creatividad y las funciones ejecutivas en alumnos de Educación Infantil. *RELATEC, Revista Latinoamericana de Educación Infantil*, *5*(1), 65-73.

Rojas, J., & Tyler, K. (2018). Measuring the creative process: a psychometric examination of creative ideation and grit. *Creativity Research Journal*, *30*(1), 29-40. doi: https://doi.org/10.1080/10400419.2018.1411546.

Romo, M., Alfonso, V., & Sanchez, M. (2016). El test de creatividad infantil (TCI): evaluando la creatividad mediante una tarea de encontrar problemas. *Psicología Educativa*, *22*(2), 93-101. doi: https://doi.org/10.1016/j.pse.2016.01.005.

Runco, M. (2017). Comments on where the creativity research has been and where is it going. *The Journal of Creative Behavior*, *51*(4), 308-313. doi: https://doi.org/10.1002/jocb.189.

Sanz, N., & García, A. (2014). Los desarrolladores de libros app infantiles y juveniles: radiografía, perspectivas y modelo de negocio. *Anales de Documentación*, *17*(2), 1-18. doi: https://doi.org/10.6018/analesdoc.17.2.192131.

Shelton, C., Archambault, L., & Hale, A. (2017). Bringing digital storytelling to the elementary classroom: video production for preservice teachers. *Journal of Digital Learning in Teacher Education*, *33*(2), 58-68. doi: https://doi.org/10.1080/21532974.2016.1276871.

Sternberg, R., & Kaufman, J. (2018). Afterword: The big questions in the field of creativity now and tomorrow. In R. J. Sternberg & J. C. Kaufman

Ocnos (2019), 18 (1): 7-20
DOI 10.18239/ocnos_2019.18.1.1866

Del-Moral, M. E., Bellver, M. C., &. Guzmán-Duque, A. P.
Evaluating the creative potential of digital storytelling APPs for Primary Education

(Eds.), *The Nature of Human Creativity* (pp. 374-380). New York, EEUU: Cambridge University Press.

Taja, V., Tej, J., & Sirkova, M. (2015). Creative management techniques and methods as a part of the management education: analytical study on students´ perceptions. *Procedia. Social and Behavioral Sciences, 197,* 1918-1925. doi: https://doi.org/10.1016/j.sbspro.2015.07.563.

Tejada, J., & Pozos, K. (2018). Nuevos escenarios y competencias digitales docentes: hacia la profesionalización docente con TIC. *Profesorado, Revista de Currículum y Formación del Profesorado*, 22(1), 41-67.

Walter, E., Gioglio, J., & Roam, D. (2014). *The power of visual storytelling: how to use visuals, videos, and social media to market your brand.* New York, EEUU: McGraw-Hill Education.