CEDIS Circular Economy in Digital Storytelling

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Combined Desk Research

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1. Introduction

The CEDIS project, titled Circular Economy in Digital Storytelling, aims to reshape key ideas such as "circular economy," "sharing," "efficiency," "sustainable development," and "everyday behavior" across Europe. The primary objective is to mitigate the impact of climate change on participants' lives by encouraging more sustainable practices. The project is built upon five fundamental pillars: inclusion and diversity, environmental sustainability, circular economy principles, digital storytelling, and digital transformation.

In recent years, regions across the globe have experienced the diverse and escalating effects of climate change. CEDIS responds to this challenge by incorporating the Digital Storytelling School Education Methodology, which prioritizes collaboration and trust. This methodology promotes a culture of sharing and co-ownership, encouraging both teachers and students to explore ways of utilizing shared resources based on their needs, interests, and environments in safe and supportive settings.

Digital storytelling has become a vital tool in modern education, particularly within secondary schools. It merges the traditional art of storytelling with digital media, offering an interactive platform for learning and self-expression. The approach typically begins with students selecting topics that are meaningful to them, such as historical events or personal experiences. As they work on their stories, students develop critical thinking skills and collaborate with their peers to enhance the narrative. The process emphasizes creativity and engagement, helping students craft stories that are compelling and thought-provoking.

By fostering this combination of creativity, sustainability, and collaboration, the CEDIS project not only enriches students' educational experiences but also encourages them to rethink their relationship with the environment and the resources they use daily.

CEDIS project partnership includes eight partners from six European countries. The partners are Lern Bar from Germany, AdM and IIS Giua from Italy, SBTC from Turkey, ELC from Spain, Danmar from Poland and EIA and AEMS from Portugal. This combined report presents gathering and analyzing relevant data and materials from six partner countries.

2. The Desk Research

The main objective of this working paper was to research and compile various general and national information, data, and resources regarding Digital Storytelling as a learning methodology and Circular Economy as a topic for secondary education. Partners also investigated previous experiences of DST for teaching Circular Economy across different areas and sectors. The collected material included an up-to-date overview of software tools, particularly mobile applications, that could be used for DST. These tools were selected based on their accessibility for students, such as ease of installation, compatibility with devices, and cost (preferably free). The tools were updated in line with the ongoing development of applications and the evolving experiences of students related to video production and consumption (e.g., the shift from YouTube to TikTok among younger users). These updated tools aimed to improve media literacy for both teachers and students, covering aspects like open-source versus proprietary software and platform economy.

The participating partners selected and provided a current set of Best Practices (three per partner) related to DST and Circular Economy education, including national initiatives offering learning materials suitable for secondary school students in each partner's national language. In different countries, there were varying concerns and practices related to Circular Economy (e.g., plastic, electronic waste, car sharing, etc.). Additionally, many IT services operated on the "access vs ownership" principle, which is central to the Circular Economy field for material goods. The paper also analyzed to what extent Circular Economy, or Sustainability in general, was already integrated into school curricula.

Six expert video interviews were conducted (one per country). Finally, an exemplary list of potential topics for student videos was compiled, along with a list of possible digital tools to disseminate them.

The desk research consisted of four different sections:

● DST in the Secondary School Context. Deadline: 15/03/2024

A report was produced on up-to-date existing digital tools and devices for applying DST in schools, along with descriptive types of Digital Stories and their current use in secondary schools and usability in the classroom.

● Collection of Best Practices. Deadline: 30/04/2024

Best Practices of Digital Storytelling on Circular Economy were collected from various fields and sectors.

● National Reports about Education. Deadline: 30/04/2024

Six National Reports on Education about Circular Economy in Secondary Schools were compiled, both in English and in the six national languages of the project.

● Interview with a National Expert. Deadline: 31/08/2024

High-quality video interviews were conducted with national experts or activists on Digital Storytelling and Circular Economy, one from each partner country.

The process concluded with a comprehensive review and final validation of the collected data and materials by all project partners.

3. Key Findings on DST in the Secondary School Context

3.1 The use of DST in the Secondary School Context

Detailed information was provided on the situation in each partner country regarding the use of Digital Storytelling (DST) in schools. This included an assessment of how DST is integrated into the educational system, the types of digital tools available for students and teachers, and the extent to which DST is utilized as a learning methodology in the classroom. Additionally, the reports covered the challenges and opportunities in implementing DST, including access to technology, teacher training, and the relevance of DST in the curriculum.

These findings from six different countries offered a comprehensive overview of the varied approaches to DST in school settings, highlighting both common trends and unique practices across the regions.

- Germany

DST merges traditional storytelling with digital multimedia such as images, audio, and video, enabling students to create and share their narratives. Although digital media is becoming increasingly important in education, DST has not yet been widely adopted in German secondary schools compared to traditional teaching methods. Some federal states, like North Rhine-Westphalia, have initiated programs such as "Medienkompetenz macht Schule" to promote digital literacy, including DST, aiming to enhance both students' and teachers' digital competencies. On an individual level, some teachers have pioneered the use of DST, fostering greater student engagement, creativity, and critical thinking.

Despite its potential, the integration of DST faces challenges such as limited resources, inadequate teacher training, and varying digital literacy levels among educators. However, various organizations are stepping in to offer resources, workshops, and training to help schools adopt DST more effectively. With increased investment in digital infrastructure and

teacher development, along with collaborative efforts to share best practices, the future of DST in German secondary education is promising. If embraced fully, DST could become a key tool for preparing students for the demands of a digital world.

- Italy

In Italy, digital storytelling has become a powerful educational tool in secondary schools, offering an engaging and creative way for students to learn across various subjects. By incorporating multimedia elements such as images, videos, audio, and interactive features, digital storytelling enhances students' creativity, critical thinking, and digital literacy. It is used in subjects like language arts, history, science, and even mathematics, allowing students to build narratives through digital tools and supporting diverse learning styles. For example, in language arts, students can create multimedia presentations based on literary works, exploring themes and characters in a dynamic way.

Digital storytelling also allows students to express their ideas, perspectives, and cultural heritage, which is particularly relevant in a country like Italy with its rich historical and artistic traditions. This approach helps students connect with their local history and contemporary issues, fostering a deeper sense of cultural identity. Furthermore, it aligns with the goals of the Italian education system to promote 21st-century skills such as collaboration, communication, and media literacy. By working on digital storytelling projects, students develop teamwork and communication skills while becoming active creators in the digital age. As technology advances, leveraging digital storytelling will be essential in nurturing the next generation of critical thinkers and storytellers.

- Turkey

Turkey's education system has increasingly embraced digital technologies, including DST to enhance teaching and learning experiences. The Ministry of National Education (MoNE) has launched initiatives like the FATIH project and the EBA (Education Informatics Network) platform, which aim to digitalize education by providing the necessary infrastructure, resources, and training for teachers and students. These government-led efforts create an environment conducive to implementing DST in classrooms by offering the digital tools and platforms required for content creation and sharing. In addition, Turkey recognizes the vital role of teachers in integrating technology, and there are ongoing professional development programs aimed at improving teachers' Technological Pedagogical Content Knowledge (TPACK), although specific data on DST-focused training is limited.

While there are positive strides in integrating DST, challenges remain, such as unequal access to technology across regions and the need for more specialized training for teachers. To fully realize the potential of DST, future efforts should focus on enhancing teacher training to include DST, integrating DST projects within the curriculum, improving digital infrastructure to reduce the digital divide, and conducting further research to assess DST's impact on educational outcomes. These steps would ensure that DST becomes a more widely adopted

and effective tool for fostering creativity, critical thinking, and digital literacy among Turkish students.

- Spain

In Spain, the growing use of digital applications and virtual platforms in schools has led to changes in teacher training and curriculum development, fostering more interactive and market-driven educational experiences. DST has become a particularly effective tool for helping students acquire key skills, with its use expanding significantly in recent years. A study by the University of Murcia found that over half of secondary education teachers are aware of DST and its types, with many undergoing training in digital tools to enhance education quality. Additionally, 50% of teachers agree on the importance of using narratives in education, and the study concluded that the use of DST positively correlates with improved academic performance.

- Poland

In Poland, DST has emerged as an innovative educational tool in secondary schools, helping to increase student engagement, creativity, and overall learning outcomes. Its integration aligns with broader educational reforms focused on embedding digital skills and critical thinking into the curriculum. By allowing students to craft their own narratives using digital tools like video editing software and multimedia devices, DST not only enhances technical proficiency but also encourages personal expression and creativity.

Polish educational initiatives have increasingly emphasized project-based learning, where DST plays a crucial role. Students tackle real-world problems through digital storytelling projects, improving their research, collaboration, and communication skills. Supported by both governmental and non-governmental organizations, various programs and workshops are training teachers in digital literacy and storytelling techniques. The use of DST is not limited to language arts or ICT; it spans multiple subjects such as history, social studies, and science, enabling interdisciplinary learning. Teachers use DST to present topics from various perspectives, such as historical events, in creative ways. Teachers have successfully applied DST in remedial classes for underperforming students, indicating that the method caters to diverse learning styles and holds a promising future in Polish education.

- Portugal

In Portugal, DST has become an essential tool in secondary education for promoting social, emotional, and academic competences among young people. Over the past decades, various programs focused on developing DST skills in students have been implemented with promising results. A pioneering initiative by the Ministry of Education in the 1990s, coordinated by Matos, laid the foundation for promoting these skills in schools, emphasizing preventive approaches and teacher training. Since 2012, researchers from CIS-IUL have been working to enhance pedagogical practices in school groupings called Educational Territories of Priority Intervention (TEIP), aiming to improve school outcomes through DST education. Numerous

successful socio-emotional education programs using DST have been developed and adapted for different educational cycles. In 2015, the Portuguese Psychologists' Association launched a digital platform offering approved programs that utilize DST for socio-emotional skill development, helping schools adopt, implement, and evaluate these educational initiatives.

GENERAL COMMENT: Across the six countries—Germany, Italy, Turkey, Spain, Poland, and Portugal—there is a shared recognition of Digital Storytelling (DST) as a valuable educational tool for enhancing student engagement, creativity, and digital literacy. Each country acknowledges the importance of integrating digital tools into the classroom and highlights efforts to train teachers in using DST. Governmental initiatives, such as Turkey's FATIH project and Germany's "Medienkompetenz macht Schule," reflect a growing commitment to digital education, although the extent of DST adoption varies. In countries like Italy and Portugal, DST has become a well-established method, integrated across various subjects, while in Germany, its usage remains less widespread compared to traditional teaching methods.

Despite similarities, the focus and challenges of DST implementation differ. In Portugal, DST is used prominently for socio-emotional education, whereas in Poland, it plays a crucial role in project-based learning. Challenges such as unequal access to technology and limited teacher training are noted, particularly in Turkey and Poland, while countries like Italy and Spain have more established infrastructures supporting the use of DST. Overall, although the integration of DST is at different stages across these countries, it holds significant potential to improve learning outcomes and foster essential skills for the digital age.

3.2 Types of Digital Stories

This section presents the findings from six countries on the various types of Digital Stories currently used in secondary schools, highlighting how these stories are applied in diverse subjects to enhance student engagement, creativity, and learning outcomes.

- Germany

In Germany's decentralized education system, the integration of DST varies across states and is typically driven by individual teachers, particularly in subjects like German, foreign languages, and social studies. Narrative stories are used in language classes, allowing students to create imaginative characters and plots inspired by literature. Documentary stories are common in social sciences, where students use multimedia elements to document real-life events, social issues, or cultural traditions. Personal stories, focusing on individual experiences and emotions, are applied across all three subjects, helping students enhance self-expression, writing, and conversational skills while exploring historical, social, or cultural topics.

- Italy

In Italian secondary schools, various types of digital stories are used to enhance learning across different subjects. Narrative stories follow a linear structure, often retelling literature,

historical events, or personal experiences, and are widely used in language arts and history classes. Documentary stories, which present research and factual content, allow students to explore topics such as environmental issues in science or geography through visually engaging formats. Personal stories focus on individual experiences and reflections, helping students connect with cultural identity, family history, or social issues, while fostering empathy and understanding of diverse perspectives. Expository stories explain concepts and processes using multimedia elements, particularly in mathematics and science, where students demonstrate problem-solving techniques or illustrate scientific principles. Additionally, interactive stories, where viewers make choices that influence the narrative, are used to promote active learning and critical thinking in subjects like language arts or history.

Educators integrate these digital storytelling techniques in various ways, such as assigning projects where students create their own stories as part of assessments or classwork. Collaborative projects encourage teamwork and communication as students work together to plan and produce their digital narratives. These stories often serve as multimedia presentations during discussions or exhibitions, providing an interactive platform for students to share their work. Additionally, reflection and feedback sessions help students evaluate their storytelling process, receive feedback from peers and teachers, and refine their skills for future projects.

- Turkey

In Turkey's secondary education, DST is used to enhance digital literacy, foster creativity, and improve subject comprehension across various disciplines. Common types of DST include personal narratives, which encourage students to explore identity and culture in subjects like Turkish Language and Literature; historical documentaries, which engage students with Turkey’s rich history in History and Social Studies; and educational content stories, which simplify complex concepts in STEM subjects and languages. Additionally, instructional stories offer step-by-step guidance in practical subjects like IT, art, and physical education, while social and environmental stories raise awareness on social and environmental issues, promoting advocacy and action in line with global citizenship education goals.

- Spain

In Spain, digital storytelling in education is classified into three main types: personal narratives, which involve life experiences or creative stories with a structured beginning, middle, and conclusion; stories that analyze historical events, using archival materials to explore significant historical milestones; and informative or instructive stories, designed to present content or explain processes. Numerous initiatives, such as the EDIA project by CEDEC, support the integration of digital storytelling in schools by providing quality digital resources and fostering educational transformation. Additionally, the Sub-Directorate General for Territorial Cooperation and Innovation promotes studies and reports on innovative practices, including the use of digital storytelling in education.

- Poland

In Polish secondary schools, digital stories come in various formats, each designed to meet specific educational objectives and engage students in different ways. Personal narratives are commonly used in literature and language arts classes, allowing students to reflect on their personal experiences and develop their narrative and self-expression skills. Historical documentaries, used in history and social studies, encourage students to research and analyze historical events, fostering critical thinking and a deeper understanding of historical contexts. Explainer videos, frequently employed in science and mathematics, help students break down and explain complex concepts in an engaging, easy-to-understand format.

Instructional guides are another format, used across various subjects, where students create step-by-step tutorials, reinforcing their knowledge by teaching others. Public Service Announcements (PSAs) offer students the chance to engage with social and health-related issues, using digital storytelling to promote awareness and advocacy. These formats of digital storytelling align with Poland's educational reforms aimed at enhancing digital literacy, critical thinking, and creativity. Teacher training programs and digital tools further support the integration of these innovative methods, preparing students for the challenges of the digitalized world.

- Portugal

In Portuguese secondary schools, DST offers students an interactive way to enhance their learning through various formats of storytelling. DST is generally defined as the art of combining storytelling with multimedia elements like images, sounds, and videos to create short, engaging narratives. These stories can be categorized into three main types: personal narratives, which recount significant life events, relationships, or professional experiences; thematic and historical narratives, which depict historical events using multimedia elements such as photos and videos; and instructional narratives, designed to teach or train in specific subject areas. By utilizing DST, students creatively illustrate curricula, accommodate different learning styles, organize and structure ideas, and foster critical thinking and sharing of opinions.

GENERAL COMMENT: Across Germany, Italy, Turkey, Spain, Poland, and Portugal, DST is increasingly integrated into secondary education, serving as a versatile tool to enhance student engagement, creativity, and critical thinking. While the specific types of digital stories vary—ranging from personal narratives to historical documentaries, instructional guides, and interactive stories—they all aim to foster deeper learning and self-expression. Countries like Germany and Turkey emphasize the use of DST in language, history, and social studies, while in Italy and Spain, DST is applied across a wider range of subjects, including science and mathematics. In Poland and Portugal, DST is further supported by national educational reforms and teacher training programs, preparing students for the demands of the digital age by promoting digital literacy and active citizenship. Overall, the use of DST across these countries demonstrates its growing significance in modern education.

3.3 Usability of DST in the classroom

This section examines the practical application and usability of DST in classrooms across six countries, highlighting its role in enhancing student engagement, fostering creativity, and developing digital literacy skills within diverse educational contexts.

- Germany

In Germany, several organizations and projects are actively promoting DST in schools. One such initiative is the Erasmus+ funded DIST project, which uses DST to combat stereotypes and promote social inclusion by having students create videos to share personal stories on various topics. The Institute for Applied Children's Media Research introduces DST to students from primary school upwards, offering step-by-step teaching materials to implement DST in classrooms. Another project, "Digital Storytelling" by the Staatliches Studienseminar für das Lehramt an Realschulen plus Trier, focuses on language teaching by linking analog and digital learning paths, where students first write creative stories and then transform them into digital videos, fostering intercultural competence and democratic values.

- Italy

In Italy, DST has been embraced in various educational initiatives aimed at enhancing learning experiences, fostering creativity, and developing essential skills among students. One prominent example is the Digital Storytelling Lab by Fondazione Mondo Digitale, which promotes DST as a tool for education and social inclusion through workshops, training programs, and resources for educators and students. Similarly, the Digital Education and Narrative Creativity (EDUCAN) project focuses on empowering teachers to integrate DST into their lessons, encouraging creativity, critical thinking, and digital literacy.

Additionally, MiRacconti.it, an online platform dedicated to DST in education, showcases digital stories created by students and teachers across Italy, providing a valuable repository of examples and resources for educators. The Digital Storytelling Competition organized by Indire invites students and teachers to create digital stories on curriculum-related topics, contemporary issues, or cultural heritage, encouraging creative expression within the school setting. Another initiative, ProgettoNarrare.it, supports teachers in incorporating narrative-based learning and DST into their lesson plans to enhance communication, creativity, and empathy among students.

Lastly, the Erasmus+ funded project DIST (2017-2019) involved Italian partners and aimed to use DST to promote social inclusion and combat stereotypes in schools. Through this project, students created videos to tell their personal stories on broad themes, providing a platform for self-expression and intercultural understanding. These initiatives collectively highlight the growing role of DST in Italian education, offering diverse opportunities for both students and teachers to engage with digital tools creatively.

- Turkey

In Turkish secondary schools, DST is increasingly being integrated into teaching practices, supported by national digital education initiatives such as the EBA platform. Teachers are using DST to boost student engagement, enhance digital literacy, foster creativity, and encourage collaborative learning. Professional development programs help educators improve their skills in digital tools, ensuring effective use of DST in the classroom. National and regional competitions, alongside school-based projects, further encourage students to create and share digital stories, reflecting the growing use of technology in education. While the extent of DST use varies across regions, due to factors such as technology access and teacher expertise, it is clear that DST is being embraced as a powerful tool to enrich learning experiences.

Examples of DST use in Turkish classrooms include language and literature projects where students create personal narratives, combining elements from literary texts with personal experiences. In history and social studies, students produce historical documentaries, deepening their understanding of significant events through research and multimedia storytelling. In science classes, students explain complex scientific concepts using DST, incorporating diagrams and animations to enhance comprehension. Similarly, in mathematics, DST is used to illustrate problem-solving processes, improving students' ability to communicate mathematical reasoning. Environmental education projects encourage students to create advocacy campaigns using DST to raise awareness of local environmental issues and propose solutions.

The integration of DST in Turkish classrooms is supported through cross-curricular projects, flipped classroom models, and student portfolios. Collaborative cultural exchange projects also allow students to work with peers from other countries, fostering global awareness and intercultural communication. Overall, DST in Turkish classrooms emphasizes active learning, creativity, and the development of digital literacy, contributing to a more engaging and meaningful learning experience for students.

- Spain

The "Stories of Yesterday for People of Today" is a national initiative in Spain where students create animated digital stories using the stop motion technique. These stories are based on fragments of classic Spanish narratives, allowing students to engage creatively with traditional literature. This activity combines digital storytelling with animation to bring classic texts to life in a modern format.

The Storytelling Robots project, initiated by a school in Vila-seca, Tarragona, integrates educational robotics, audio visual creation, and collaborative work to help students learn new content while practicing foreign languages, particularly English. Students work together to create a game based on illustrated albums and audio visual content, which can then be shared with other schools, encouraging both creativity and language learning.

In another innovative activity, The Periodic Table of Storytelling, stories are linked to the elements of the periodic table, specifically the semi-metals. This activity narrates the seven elements—Boron, Silicon, Germanium, Arsenic, Antimony, Tellurium, and Polonium—in a way that helps students remember their order and properties. According to feedback, this approach has significantly improved students' performance in physics and chemistry.

- Poland

In Poland, DST is being utilized by teachers to enrich students' learning experiences, foster digital fluency, and engage students more deeply with academic content. By integrating DST into creative writing, literature, history, and language lessons, students are able to bring narratives to life digitally, exploring literary concepts, historical events, and social issues in a dynamic way. This method enhances students' analytical, creative, and multimedia storytelling skills while also improving language fluency through active, creative expression. DST not only serves as an innovative pedagogical tool but also emphasizes the importance of digital literacy, equipping students with critical 21st-century skills like critical thinking, digital competence, and effective communication, preparing them for future challenges in a technology-driven world.

- Portugal

In Portuguese secondary schools, DST is widely used across various subjects to enhance student engagement and learning. In literature classes, students create multimedia presentations based on classic works, analysing characters and themes through digital media. In history, students research events and present them via interactive timelines, incorporating images, videos, and primary sources. Foreign language classes use DST to improve language proficiency, with students producing films or animations in the target language. In science, DST helps students communicate complex concepts or demonstrate experiments using visuals and voiceovers. In civics and social studies, students create documentaries or stories to raise awareness about social issues, using their digital skills to advocate for positive change in their communities.

GENERAL COMMENT: Across Germany, Italy, Turkey, Spain, Poland, and Portugal, DST is being increasingly adopted as an innovative educational tool to enhance learning, foster creativity, and develop critical skills among students. Each country demonstrates a unique approach to integrating DST across subjects such as literature, history, science, and language, providing students with opportunities to engage more deeply with content while developing digital literacy and collaborative skills. National and regional initiatives, along with school-based projects and competitions, support the creation and sharing of digital stories, helping students blend technology with traditional learning methods. Overall, DST plays a vital role in enriching education, promoting cultural exchange, social inclusion, and preparing students for the demands of the digital age.

3.4 Digital tools and devices

This section explores the various digital tools and devices that support the creation and implementation of DST across six countries, highlighting their role in enhancing students' multimedia skills and facilitating interactive learning experiences in diverse educational contexts.

- Germany

In Germany, several digital tools are widely used to enhance creative learning and storytelling in educational settings. *Book Creator* allows students and teachers to design interactive e-books, comics, and presentations, fostering creativity and teamwork. *Adobe Spark* is a popular platform for creating graphics, websites, and videos, supporting multimedia content creation for school projects and presentations. *Microsoft PowerPoint* continues to be a staple tool for creating visually engaging presentations with animations, offering students a platform to tell stories and present complex ideas. *Storybird* is used for creative writing projects, enabling students to create illustrated stories while enhancing their language skills. Lastly, *Twine* offers a unique way for students to create interactive, text-based stories and games, providing an engaging platform for storytelling and decision-making. These tools collectively support digital literacy and foster creativity in German classrooms.

- Italy

In Italy, several digital tools are utilized for creative storytelling and multimedia content creation in educational settings. *WeVideo* is a cloud-based video editing platform that supports collaborative video creation, ideal for educational content and social media projects. *Toonly* allows users to create animated videos through a simple drag-and-drop interface, making it perfect for explainer videos and educational presentations. *StoryMapJS* enables the creation of interactive, multimedia-rich story maps that combine maps, images, videos, and text, often used for geographical and historical narratives. *Animoto* is another cloud-based platform that allows users to create professional-quality videos using customizable templates, simplifying the video creation process for educators and students. Lastly, *ThingLink* enhances interactivity by allowing users to add interactive hotspots to images, videos, and 360-degree media, commonly used for virtual tours and educational presentations. These tools collectively foster digital literacy, creativity, and engagement in Italian classrooms.

- Turkey

In Turkey, several digital storytelling tools are utilized in educational settings to foster creativity and engagement. *Storyjumper* allows users to create personalized storybooks with custom imagery and narration, enhancing creative writing and collaboration among students. *Pixton* offers a platform for creating comics and avatars, making it ideal for visual storytelling and educational content creation. *Storyboard That* simplifies the process of creating digital storyboards, making it easy for students to visualize scenes and plan narratives for various projects. *Animaker* provides an AI-powered animation tool that allows students and teachers

to produce animated educational videos and presentations, making complex concepts more accessible. Lastly, *Storybird* empowers young writers to create unique stories with beautiful illustrations, improving writing skills and engagement through artful storytelling. These tools collectively support creative expression and digital literacy in Turkish classrooms.

- Spain

In Spain, several digital storytelling tools are used in educational settings to foster creativity and engagement among students. *CreAPPcuentos* allows students to create personalized stories with custom backgrounds, characters, and audio, encouraging creativity and digital skills. *Sway*, a Microsoft application, enables users to create interactive, multimedia-rich presentations ideal for both students and teachers. *StoryJumper* allows users to create, narrate, and publish storybooks, making it a valuable tool for storytelling in classrooms. *Pixton* offers the ability to create comics and storyboards, reinforcing educational content through visual storytelling, while *Buncee* is a versatile content creation tool that supports digital storytelling, multimedia presentations, and classroom projects with a drag-and-drop interface. Together, these tools enhance digital literacy, storytelling, and multimedia creation in Spanish classrooms.

- Poland

In Poland, several digital tools are widely used to enhance creativity, collaboration, and interactive learning. *Canva* is a versatile graphic design tool that allows users to create visually appealing content, including presentations, posters, and infographics, with its vast library of templates and design elements. *Genially* is another popular platform for creating interactive presentations, infographics, and videos, ideal for engaging audiences. *Prezi* offers a dynamic, non-linear presentation experience, making storytelling more immersive and memorable. *Mentimeter* enhances audience engagement with real-time polling, quizzes, and feedback, encouraging active participation during presentations. Lastly, *Adobe Spark* enables users to effortlessly create graphics, videos, and web pages, empowering students, educators, and professionals to produce captivating visual content. These tools collectively support interactive and creative learning in Poland's educational landscape.

- Portugal

In Portugal, digital tools like *GoAnimate*, *MakeBeliefsComix*, *Animoto*, *Storybird*, and *Vev* are widely used to foster creativity and enhance digital storytelling in education. *GoAnimate* allows students and educators to create animated videos, making learning more interactive and engaging. *MakeBeliefsComix* offers a platform for creating comics, encouraging students to develop storytelling and visual literacy skills. *Animoto* is a popular tool for creating multimedia presentations with videos, photos, and music, while *Storybird* empowers students to craft stories with beautiful illustrations, improving writing and creative expression. Finally, *Vev* supports the creation of interactive and dynamic visual content, enhancing student

engagement in digital media projects. Together, these tools promote creativity, storytelling, and digital literacy across educational settings in Portugal.

4. Collection of Best Practices of Digital Storytelling on Circular Economy

This section presents a collection of best practices in DST related to the Circular Economy from six countries, showcasing how innovative storytelling techniques are being used to educate and engage students and communities on sustainability, resource management, and environmental responsibility.

4.1 Introduction to the selection of the best practices

In this sub section, the selection of best practices process is presenting.

- Germany

In Germany, the selection criteria for best practices in Digital Storytelling (DST) related to the circular economy were based on their relevance to the topic and suitability for secondary school vocational students. The chosen practices, such as *Circular Munich Knowledge Hub*, *Cradle to Cradle (C2C)*, and *Die Sendung mit der Maus. Sachgeschichten: Umweltschutz an Schulen*, were selected for their clear focus on sustainability, practical applications, and accessibility. Each practice offers diverse educational formats, including digital platforms, podcasts, documentaries, and interactive tools, catering to different learning styles. Additionally, these practices emphasize real-world applications, such as urban sustainability projects, changes in consumption habits, and environmental protection measures in schools, allowing students to connect theory with practical actions in their daily lives. The multimedia approach and hands-on learning opportunities provided by these best practices ensure a comprehensive and engaging learning experience in the field of the circular economy.

- Italy and Turkey

In Italy and Turkey, the selection of best practices for using DST to teach Circular Economy and sustainability for the CEDIS project was guided by four key criteria: innovation, engagement, scalability, and impact. The chosen practices had to showcase innovative approaches by incorporating multimedia elements like videos and interactive graphics to explain complex sustainability concepts. They prioritized audience engagement through interactive storytelling techniques such as gamification and immersive experiences, encouraging active participation and critical thinking. Scalability was also essential, ensuring these practices could be adopted across various educational settings and target audiences. Lastly, the selected examples demonstrated measurable impact, including increased awareness and positive behavioral changes toward sustainability and circular economy principles. These criteria ensured the practices were both effective and adaptable for broader use in education.

- Spain

In Spain, the selection of best practices for DST in teaching Circular Economy was based on two key dimensions: content and results. The content criteria focused on the alignment of practices with general and specific objectives, the involvement of relevant stakeholders, the resources allocated for implementation, and the methodology used. Additionally, the practices were evaluated for their innovation in terms of resources, methods, and target audience, as well as their sustainability and social responsibility. The results criteria assessed the effectiveness in achieving objectives, the efficiency in terms of resource usage, and the overall impact or success of the outcomes. These criteria ensured that the chosen practices were both effective and innovative, serving as models for broader educational application.

- Poland

In Poland, the collection of best practices in digital storytelling on the circular economy highlights innovative and impactful approaches to communicating the principles of sustainability. The selection criteria focused on relevance to the circular economy, emphasizing storytelling that promotes concepts like reducing, reusing, recycling, and recovering. Priority was given to projects that effectively raise public awareness and motivate action through creative, multimedia storytelling techniques. Initiatives were chosen for their ability to make complex concepts accessible to a broad audience, including non-specialists, while promoting inclusivity and participation. Scalability and adaptability for other communities or sectors were also considered important, along with the sustainability of the storytelling methods themselves. Finally, the effectiveness of each project in conveying the circular economy message, engaging audiences both emotionally and intellectually, and inspiring meaningful action was key. These best practices set a standard for future storytelling efforts around sustainability in Poland.

- Portugal

In Portugal, digital storytelling has become a powerful tool for promoting the principles of the circular economy, leveraging the country's innovation ecosystem and cultural heritage to inspire action and foster engagement. Through multimedia content like videos, interactive websites, and social media campaigns, a diverse range of actors— from start ups to established organizations—communicate the concepts of reuse, repair, and recycling in accessible and compelling ways. The selected best practices in digital storytelling highlight educational campaigns for consumers and industry-led initiatives that promote sustainable production and consumption. These initiatives are chosen based on their scalability, measurable impact, and inclusivity, ensuring they drive meaningful change towards a more circular and sustainable future. Portugal's approach exemplifies how innovation and sustainability can converge to create lasting societal and environmental benefits.

4.2 Best practices

18 best practices from six partner countries are presenting in this section.

Case Study 1: Circular Munich Knowledge Hub

The "Circular Munich Knowledge Hub" is a comprehensive digital platform aimed at educating and engaging the community on circular economy practices to build a more sustainable and resilient city. Developed with input from the Circular Munich community through surveys and interviews, the platform consolidates resources and information related to the circular economy and its application in urban settings. It offers a well-curated collection of content across four main areas: basic circular economy concepts, Munich-specific case studies, practical steps for integrating circular practices in daily life, and active learning events. The hub utilizes a variety of media, including podcasts, documentaries, songs, and book recommendations, ensuring the platform caters to diverse learning styles and interests. Through digital storytelling, the platform effectively communicates complex circular economy ideas using personal stories, videos, infographics, and interactive features, making the information engaging and accessible.

The "Circular Munich Knowledge Hub" addresses three key issues: education and awareness-raising, collaboration and community engagement, and practical implementation. It aims to increase understanding of circular economy principles among businesses, policymakers, educational organizations, NGOs, and the public through workshops, resources, and events that demonstrate the benefits of sustainable practices. The hub also promotes collaboration by connecting different stakeholders to foster collective action, while offering practical tools and case studies to guide the implementation of circular practices, such as waste reduction and sustainable resource management. The outcomes of the hub, including the Go Circular Challenge, have led to significant waste reduction, mindset shifts towards sustainability, and the discovery of circular business models, showcasing the hub's positive impact on promoting circular economy practices in Munich.

Case Study 2: Cradle to Cradle (C2C) in Berlin

The **"Cradle to Cradle (C2C)"** case study showcases a non-profit organization's innovative approach to promoting sustainability through the cradle-to-cradle design concept. Based in Berlin, C2C works to create a world without waste by encouraging individuals, businesses, and communities to rethink their production and consumption habits. By linking various sectors—including business, science, education, politics, culture, and civil society—C2C ensures a holistic approach to sustainability. Through digital storytelling methods, such as recorded talks, blogs, and interactive learning tools, the organization educates its audience on circular economy principles. Tools like the digital learning platform LOOP guide users through creative processes, while the C2C LAB in Berlin provides both digital and physical storytelling experiences to enhance understanding. These innovative methods make C2C's circular economy message accessible and engaging to diverse audiences.

The C2C case study focuses on three key issues: promoting the cradle-to-cradle design concept, encouraging changes in production and consumption practices, and fostering cross-sector collaboration. The organization emphasizes the development of products that can circulate within biological and technical cycles, advocating for sustainable design that minimizes waste. C2C also works to change how businesses and individuals approach sustainability, offering practical tools and educational content to help transition towards greener practices. Moreover, the organization promotes collaboration across different sectors, helping create a unified movement toward the circular economy. Through these efforts, C2C not only raises awareness but also drives significant action toward social and environmental sustainability, supporting fair labor standards and advocating for resource-efficient, eco-friendly products.

Case Study 3: Die Sendung mit der Maus

The case study of "**Die Sendung mit der Maus**" highlights how this long-standing German children's television program uses digital storytelling to educate young audiences about environmental issues and the circular economy. Since its inception in 1971, the show has become renowned for presenting complex topics in a simple, child-friendly way. Through engaging characters like a mouse, elephant, and duck, the show incorporates fun storytelling to explain concepts like sustainability, recycling, and waste management. It uses investigative journalism techniques, with reporters visiting schools actively involved in innovative environmental projects, such as solar energy production, wind energy usage, and carpooling initiatives. These school visits showcase how students can contribute to environmental protection, offering concrete examples and encouraging children to apply these practices in their own lives.

"Die Sendung mit der Maus" addresses three key issues: environmental education, raising environmental awareness, and providing practical examples of circular economy initiatives. The show plays a significant role in sensitizing children to sustainability topics and demonstrating how simple, creative projects can lead to meaningful environmental change. By offering relatable stories and practical demonstrations from schools, the program helps

children understand the impact of environmental protection efforts and inspires them to engage in sustainability activities. Through its entertaining yet educational format, "Die Sendung mit der Maus" has become a powerful tool for fostering environmental consciousness in younger generations.

Case Study 4: Italian Atlas of Circular Economy

The Italian Atlas of Circular Economy is an interactive and geo-referenced web platform that showcases over a hundred stories of companies and associations dedicated to the principles of the circular economy. Promoted by Ecodom and CDCA, the Atlas gathers experiences from across Italy, focusing on reuse, waste reduction, and the reintegration of secondary raw materials into production cycles. It serves as a comprehensive tool for raising awareness, fostering connections, and increasing the visibility of sustainable practices. The platform offers users the ability to explore these experiences through regional searches or by product or service categories, and it is regularly updated through a participatory mapping process. The Atlas also launched a competition for journalists, videomakers, photographers, and storytellers to document and share these circular economy practices, further amplifying awareness and promoting responsible consumption behaviors.

Through this initiative, the Atlas addresses three key issues: raising public awareness about the balance between economy and ecology, fostering collaboration and synergies between sustainable companies and associations, and providing detailed assessments of circularity based on various indicators such as raw materials, energy efficiency, waste management, and social value creation. With over 100 stories already mapped, the platform highlights regions like Lombardy, Lazio, and Tuscany as leaders in circular economy practices. The Atlas of Circular Economy exemplifies how digital storytelling can drive awareness and inspire sustainable consumer behaviours, making it a valuable tool in Italy's efforts towards a more sustainable future.

Case Study 5: Digital Storytelling Workshop in Primary School

The **"Digital Storytelling Workshop in Primary School"** case study, conducted at the "S. Giovanni Bosco" primary school in Marostica, Italy, explored the use of Digital Storytelling (DST) as a method to promote environmental awareness, particularly focusing on reducing waste and recycling practices. Developed as part of a Master's thesis, the project involved fourth-grade students who were already familiar with environmental issues. The research aimed to demonstrate the educational value of DST, which combines traditional storytelling with technology to create a dynamic and engaging learning environment. Using a multidisciplinary approach that integrated subjects like Science, Arts, Italian, Computer Science, and Maths, the project enabled students to actively participate in creating digital narratives that fostered a deeper understanding of ecological responsibility.

The case study highlights how DST was used to address environmental challenges, such as waste reduction and the importance of recycling, by encouraging students to create a digital storytelling video. The project was driven by the question, "What can I, in my own small way,

do to make a difference?"—a prompt that arose from student discussions after watching a video on environmental pollution. The hands-on nature of the project, combined with its focus on media and collaborative education, showed that DST can be a powerful tool for engaging young learners in meaningful, real-world issues. The success of the project, as evidenced by the students' increased awareness and motivation, confirms that DST is both an effective and challenging methodology for enhancing environmental education in primary schools.

Case Study 6: Digital Storytelling: The Reuse of the Mismatched Sock

The case study **"Digital Storytelling: The Reuse of the Mismatched Sock"** was carried out in the fifth grade classes of the Istituto Comprensivo di Sigillo in 2013 as part of the Eco-Scratch project. This initiative was created in collaboration with associations and schools during the European Week for Waste Reduction. The primary objective was to educate students on waste reduction, reuse, and recycling while introducing them to creative thinking and coding through Scratch, a visual programming software. Pupils were tasked with creatively reusing discarded items like yogurt pots, cardboard, and mismatched socks to make Christmas decorations. The process, from physical experimentation with these objects to the creation of animated digital stories using Scratch, allowed students to narrate their recycling experiences in a fun and educational manner.

The project addressed several important issues, including raising awareness of waste reduction, promoting creative problem-solving, and fostering interdisciplinary learning. Students were encouraged to think divergently, finding new purposes for discarded items, and documenting these transformations through coding. The learning objectives were multidisciplinary, aimed at developing communication skills in both Italian and English, enhancing computational thinking, and encouraging care for the environment. The animations created by the students were shared in the European Week for Waste Reduction community and uploaded to Scratch's online platform, allowing students to showcase their understanding of circular economy principles through digital storytelling. This case study exemplifies how hands-on, creative methods can be combined with technology to teach students about environmental stewardship and innovative thinking.

Case Study 7: Circular Tales: Empowering Communities for Sustainable Practices

The "Circular Tales: Empowering Communities for Sustainable Practices" initiative was developed in urban areas of Turkey to address waste management challenges and promote circular economy principles. It involved collaboration between environmental NGOs, local municipalities, and digital media experts, using DST as a key method to engage citizens. Through workshops and community gatherings, residents shared personal stories about waste reduction and sustainability, which were transformed into multimedia content such as films and animations. The initiative targeted a diverse audience, including urban residents, policymakers, educators, and students, aiming to foster behavioural change, community engagement, and policy advocacy. "Circular Tales" has successfully raised public awareness and inspired widespread adoption of sustainable practices, reaching millions through online platforms and community screenings. The project highlights the social, environmental, and

economic benefits of a circular economy, encouraging collective action and dialogue for systemic change.

Case Study 8: From Waste to Wealth

"From Waste to Wealth" is a collaborative initiative developed by academics, industry stakeholders, and digital media producers to bridge the gap between theoretical knowledge and practical solutions in the circular economy. This project focused on using digital storytelling to foster creativity and interdisciplinary collaboration, while highlighting advanced research, technology, and business models that are driving Turkey's shift towards a circular economy. By organizing multimedia storytelling workshops, the project facilitated the sharing of experiences, insights, and success stories among researchers, entrepreneurs, and policymakers involved in circular innovation projects. The resulting digital storytelling platform includes video interviews, case studies, interactive maps, and educational tools, aimed at inspiring and educating a broad audience, including students, professionals, and policymakers.

The initiative has addressed key issues such as knowledge sharing, collaborative learning, and market transformation by disseminating best practices and encouraging interdisciplinary dialogue among diverse stakeholders. It aims to accelerate the transition to a circular economy in Turkey by promoting awareness of the economic, environmental, and social benefits of circular products and services. "From Waste to Wealth" has become a leading knowledge-sharing platform, attracting thousands of users and contributors from various sectors, fostering new partnerships, investments, and policy initiatives to support circular innovation.

Case Study 9: EcoHeroes

"EcoHeroes" is an educational initiative designed to empower students in primary and secondary schools across Turkey as agents of change in advancing the principles of the circular economy. Developed in collaboration with schools, environmental NGOs, and digital media experts, the project integrates sustainability education into the school curriculum, inspiring students to lead sustainable lifestyles and drive systemic change within their communities. The initiative uses Digital Storytelling as a core methodology, engaging students in hands-on learning experiences. Through workshops, classroom activities, and digital storytelling assignments, students explore circular economy concepts such as resource efficiency, waste reduction, and sustainable consumption. Guided by educators and environmental mentors, they identify local environmental challenges and communicate their solutions through creative digital media projects, including short films, podcasts, and social media campaigns.

"EcoHeroes" addresses critical issues such as environmental literacy, student empowerment, and community engagement. By fostering critical thinking, creativity, and teamwork, the initiative enables students to take responsibility for their learning and become advocates for sustainable development. The program has positively impacted school environments, reduced ecological footprints, and raised awareness of circular economy principles through student-

led initiatives like waste audits, eco-clubs, and community clean-up campaigns. The initiative has successfully strengthened connections between schools, families, and local communities, fostering a shared commitment to environmental stewardship and sustainability.

Case Study 10: La Familia Soste-Nible

"La Familia Soste-Nible" is an animated mini-series consisting of 47 micro-episodes focused on environmental education and the circular economy, aligned with the 2030 Sustainable Development Goals (SDGs). It covers key topics such as responsible production and consumption, climate action, sustainable cities, and ecosystems. Created by the Llobregats Association and recognized by Spain's Ministry for Ecological Transition, the series is designed to raise awareness among children and the general public about the circular economy and the responsibilities of citizens in reducing waste and environmental impact. The episodes offer practical tips and explain how circular economy practices are structured in Spain and Europe, highlighting everyday actions that contribute to sustainability.

This digital storytelling initiative uses a simple and engaging format to introduce the circular economy to a wide audience, particularly students and citizens. By making viewers feel like protagonists in the narrative, the series fosters a sense of responsibility and encourages individuals to actively participate in sustainable practices. It addresses issues like the reduction of carbon footprints and environmental protection, aiming to build real awareness of climate change and inspire behavioral change towards more sustainable living.

Case Study 11: Digital Storytelling for Teachers

"Digital Storytelling for Teachers" is a Spanish government initiative aimed at enhancing teachers' skills in ICT by applying them to their professional work. Developed by INTEF (Instituto Nacional de Tecnologías Educativas y de Formación del profesorado), this online course runs over two months and guides teachers through interactive tasks in creating digital narratives. The course fosters collaboration, with teachers engaging in shared spaces, using Twitter, and forming a learning community. The essence of the course is to use digital storytelling as a tool to transform passive spectators into active users, allowing them to not only experience the story but to interact with it, enhancing their intrinsic motivation to discover and learn.

The application of DST in teaching provides teachers with the resources and knowledge necessary to effectively use this tool across various educational fields, including the circular economy. With proper training, teachers can integrate DST into their curriculum, using it as a powerful means to engage students in sustainability and environmental issues. The course equips teachers to motivate students in creating their own digital stories, helping them explore complex topics like the circular economy in an interactive and compelling way. The outcome is better-equipped educators who can use digital resources to inspire and educate students on sustainable practices.

Case Study 12: ¿Qué es la economía circular?

The case study **"¿Qué es la economía circular?"** is a video created by the Ministry of Ecological Transition and Demographic Challenge in Spain, designed to explain the concept of the circular economy and its benefits through a narrated story. Using graphic and visual elements, the video aims to reach a younger audience and raise awareness about how adopting circular economy practices can positively impact our lives. Published on YouTube, it is accessible to a broad audience, particularly targeting young people who frequently use the platform. The video effectively combines storytelling with data and images to highlight the urgent need for action in response to climate change, emphasizing the role that transitioning to a circular economy can play in mitigating environmental damage.

By employing the methodology of digital storytelling, the video creates an emotional connection with viewers, helping them internalize the concept of circular economy through a relatable and engaging narrative. The video addresses three key issues: educating young people about the circular economy, raising awareness of its impact on daily life, and conveying this information in an entertaining and impactful manner. With over 54,549 views, the video has successfully reached a wide audience, making a significant contribution to promoting sustainability and the circular economy among young people and social media users.

Case Study 13: Circular Economy Club (CEC)

The Circular Economy Stories initiative, launched by the **Circular Economy Club (CEC),** aims to inspire global action by sharing success stories, innovative practices, and educational insights into the circular economy. By featuring real-world examples of how circular economy principles are being applied across different industries and sectors worldwide, the project seeks to foster a global community of practice. The initiative uses digital storytelling (DST) through various formats such as video interviews, written case studies, and interactive webinars. These stories highlight the efforts of entrepreneurs, businesses, policymakers, and educators in implementing circular economy solutions, making the concept more tangible and relatable to diverse audiences.

The project addresses three critical areas: innovation in circular economy practices, leadership and policy development, and education and community engagement. By showcasing new business models and technologies that enhance resource efficiency and waste reduction, the initiative underscores the potential of circular practices to transform industries. Additionally, it demonstrates the importance of policy and leadership in driving circular economy adoption, while also emphasizing the role of education in spreading these principles and engaging communities. The initiative has successfully connected a global network of circular economy practitioners, promoting collaboration and inspiring governments and businesses to implement circular solutions worldwide.

Case Study 14: Rekopol Organizacja Odzysku Opakowań S.A

Rekopol Organizacja Odzysku Opakowań S.A. is a leading force in Poland's efforts to implement circular economy principles, with a specific focus on the recovery and recycling of

packaging waste. Operating nationwide, Rekopol plays a crucial role in managing packaging waste by collecting, recycling, and reusing materials, as part of Poland's strategy to improve recycling rates and reduce landfill usage. The organization actively engages in public awareness campaigns and educational initiatives, targeting consumers, businesses, schools, and local communities to promote responsible waste management. Through collaborations and media outreach, Rekopol shares stories and case studies that emphasize the importance of recycling and the environmental benefits of reducing packaging waste.

Rekopol addresses three main issues: reducing waste, enhancing recycling infrastructure, and raising public awareness about sustainable waste management practices. By increasing recycling rates and fostering public engagement, the organization contributes significantly to Poland's sustainability goals. Their initiatives have led to improved recycling systems, greater public participation in recycling programs, and more sustainable packaging practices, reinforcing the importance of circular economy principles in everyday life.

Case Study 15: Eco-educational Initiatives in Gdańsk

The eco-educational initiatives in Gdańsk are part of the city's ongoing commitment to integrating sustainability and circular economy principles into urban development and educational programs. While not exclusively focused on digital storytelling, these initiatives utilize digital platforms, social media, and online resources to raise awareness about the importance of waste reduction, recycling, and sustainable living. Through interactive campaigns, informational videos, and online workshops, Gdańsk aims to educate the public—particularly schoolchildren, families, and local businesses—on how they can contribute to a more sustainable urban environment.

These initiatives address key issues such as environmental education, community engagement, and the development of supportive policies for circular economy practices. By fostering a sustainability-minded generation and encouraging active participation in recycling and waste management, Gdańsk has seen improved recycling rates and greater public involvement in sustainability efforts. The success of these programs has not only strengthened community engagement but also contributed to the city's efforts to implement policies that support the circular economy in urban planning and waste management.

Case Study 16: The Circular Schools Program by Quercus

The Circular Schools Program, launched by Quercus in collaboration with educational institutions across Portugal, integrates circular economy concepts into school curriculums through the use of DST tools. This program engages students, teachers, and administrators with topics like waste reduction, resource efficiency, and sustainable consumption through interactive e-books, educational videos, and online workshops. By using real-life case studies, role-playing exercises, and virtual simulations, the program immerses students in real-world scenarios, allowing them to explore the challenges of transitioning to a circular economy. Theincorporation of gamified learning experiences further enhances the educational process

by offering quizzes and challenges that reinforce circular economy principles in a fun, interactive way.

The Circular Schools Program not only promotes environmental education and the principles of the circular economy but also empowers students to become active change agents within their communities. By producing videos, digital artworks, and other student-generated content, participants can express their understanding of sustainability while fostering critical thinking and problem-solving skills. The program's collaborative approach has helped to raise awareness of circular economy concepts across educational settings in Portugal, creating a lasting impact on future generations.

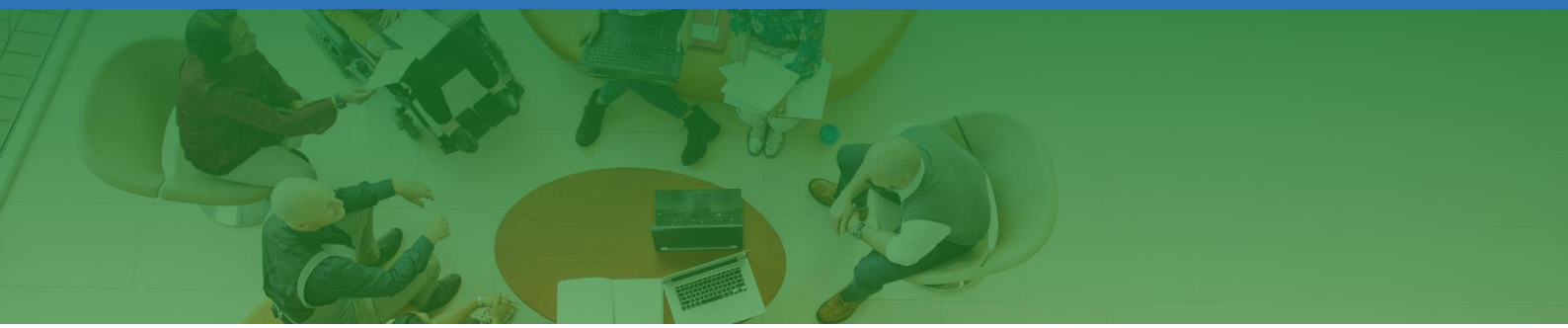
Case Study 17: The Educational Action: Educating for Climate Change by LPN

The Educational Action: Educating for Climate Change by LPN is a targeted online learning program that connects the themes of climate change and the circular economy for the educational sector in Portugal. Developed by LPN (Liga para a Proteção da Natureza), the initiative aims to promote sustainability through continuous learning sessions and workshops designed for teachers, educational experts, and school advisors. The program focuses on equipping participants with knowledge and tools to integrate circular economy principles into their teaching practices. By incorporating the methodology of Digital Storytelling (DST), the sessions provided an engaging framework for understanding the differences between linear and circular economies, offering examples of educational practices and resources that can be applied in schools.

One of the key elements of the program was the inclusion of expert speakers such as the Secretary of State for the Environment, Inês Costa, and other prominent figures from the sustainability field. These storytelling moments enriched the learning experience by communicating real-world insights and visions for advancing the circular economy agenda. The program addressed critical issues such as recycling, sustainability, and fostering critical thinking among students, ultimately contributing to a more environmentally conscious education system in Portugal. Through its comprehensive approach, the initiative has enhanced awareness and promoted practical applications of the circular economy in the educational sector.

Case Study 18: Let's Reinvent the Future

"Let's Reinvent the Future" is an environmental education program developed by the Portuguese Pact for Plastics (PAC) to promote the circular economy and raise awareness about responsible plastic usage. Targeting children, teachers, and guardians, the initiative uses Digital Storytelling (DST) to convey its message through the character PAC, a young boy striving to save the planet from plastic pollution. The program emphasizes better management of plastic waste, integrating recycled plastic into new packaging, and ensuring proper recycling. By creating engaging videos and digital content, the initiative inspires action and educates its audience on sustainability and circular economy principles, contributing to a culture of environmental responsibility in Portugal.



5. National Reports about Education on Circular Economy in Secondary Schools

This section presents national reports on Circular Economy education in secondary schools, offering an overview of each country's approach to integrating circular economy principles into the curriculum. It highlights government guidelines for transitioning from a linear to a circular economy, examines the strategies for sustainable development, and provides insights into the circular economy perspectives from six partner countries.

- Insights from Germany

Education on the circular economy is gaining increasing importance in German schools, particularly in secondary education. The goal is to install in students the understanding that resources should be used efficiently, waste minimized, and materials reused. By integrating the circular economy into the curriculum, students are equipped with the skills and knowledge needed to contribute to a resource-efficient and sustainable society. National action plans such as "Education for Sustainable Development," supported by the German Federal Government, make the circular economy a core topic for students to engage with both theoretically and practically.

The Federal Ministry of Education and Research plays a significant role in advancing education on the circular economy by supporting various projects and initiatives that raise awareness of sustainability in schools. Regional and local programs further assist teachers by providing interdisciplinary teaching units and organizing project days, enabling students to apply circular economy principles in real-life contexts. The government also funds research projects aimed at developing innovative recycling technologies and sustainable business models, fostering the transition from a linear to a circular economy.

Germany's transition to a circular economy is guided by numerous government strategies and regulations. The Circular Economy Act, for instance, sets the framework for waste reduction, recycling, and environmentally friendly disposal practices, while the Packaging Act ensures

that manufacturers and distributors take responsibility for packaging waste. Additionally, digital platforms and e-learning tools have been promoted to provide students and teachers with valuable resources on circular economy concepts. These initiatives highlight Germany's focus on resource efficiency, recycling, and sustainable product design.

The circular economy in Germany is closely aligned with sustainable development goals, with programs such as the "Deutsche Ressourceneffizienzprogramm" driving resource-efficient practices across sectors like production, construction, and consumer goods. The Circular Economy Initiative Deutschland further promotes collaboration between businesses, science, and society to develop innovative circular economy solutions. Germany's approach involves creating business models centered on services rather than products, fostering a shift towards sustainability in both production and consumption.

Germany views the circular economy as crucial to achieving a sustainable and future-oriented economy. The transition from a linear economy is seen as essential for conserving natural resources, protecting the environment, and enhancing economic competitiveness. Through legislation, research, education, and promotion of sustainable business models, Germany remains committed to integrating circular economy principles across all sectors and preparing future generations to contribute to a more sustainable world.

- Insights from Italy

Italy, like many European nations, is increasingly integrating CE education into its national agenda, especially within secondary schools. Recognizing the importance of resource efficiency and minimizing waste, Italian schools aim to equip students with the knowledge and skills necessary for sustainable development. In alignment with the European Union's commitment to sustainability, CE education emphasizes recycling, reusing, and reducing waste, fostering environmental awareness among students. Governmental and non-governmental organizations play a vital role in supporting these educational efforts, with schools incorporating both theoretical and hands-on components to give students a comprehensive understanding of circular economy principles.

The Italian government has taken significant steps to support the transition from a linear to a circular economy through initiatives like the National Strategy for the Circular Economy and the National Waste Management Programme, both launched in 2022. These programs aim to create markets for recycled materials, foster innovation, and promote producer responsibility, ensuring companies take on more of the lifecycle costs of their products. Financial incentives such as grants and subsidies further encourage businesses to adopt CE practices. Moreover, the government prioritizes education and awareness to foster a cultural shift toward sustainability, integrating circular economy concepts into curricula and promoting collaboration between public and private sectors.

Italy's circular economy framework is based on three core principles: closing the loop, cascading materials, and regenerating natural systems. These principles emphasize reducing

waste, extending product lifespans, and maximizing resource efficiency through practices such as repair, reuse, and recycling. Eco-design, where products are created to be easily disassembled and reused, is also encouraged, alongside the growth of the sharing economy. Italy excels in recycling compared to other EU nations, and the government continues to foster innovation in circular practices, aiming to reduce dependence on virgin materials and contribute to a more sustainable economy.

Italy approaches the circular economy and sustainable development through both top-down and bottom-up strategies. At the national level, the government's policy initiatives set the direction for CE, with regulations incentivizing eco-friendly practices and the promotion of innovation. On the grassroots level, schools play a crucial role in integrating CE principles into their curricula, and local initiatives encourage stakeholder involvement. Platforms like the Italian Circular Economy Platform (ICESP) promote collaboration among government, businesses, and NGOs, while regions and cities implement their own circular programs, contributing to the country's overall progress.

- Insights from Turkey

Turkey is making significant strides in incorporating Circular Economy (CE) principles into its national educational agenda, especially within secondary schools. Through a strategic public policy project led by the Ministry of National Education, in collaboration with other ministries, circular economy education is being integrated into curricula to raise awareness among young people. This initiative reflects the country's broader commitment to sustainability and resource efficiency as it seeks to educate future generations about the importance of reducing waste, reusing resources, and transitioning towards a sustainable economic model.

The government's approach to CE education is multifaceted, involving curriculum integration, experiential learning opportunities, teacher training programs, and collaboration with various stakeholders. The goal is to equip students with the knowledge, skills, and attitudes needed to thrive in a circular economy. Real-life projects such as waste audits, upcycling workshops, and sustainable design challenges provide students with practical insights into how the circular economy works in everyday life, encouraging them to take an active role in environmental protection.

At the national level, Turkey's Ministry of Education has established clear guidelines to transition from a linear to a circular economy, which includes fostering innovation, resource efficiency, and waste management. These initiatives are complemented by investments in infrastructure and the promotion of sustainable school environments. Collaboration across sectors is key, with partnerships between government, industry, and civil society helping to drive systemic change and support the integration of circular economy principles into education and everyday practices.

The conceptual framework of Turkey's circular economy is built on resource efficiency, waste management, innovation, and education. The country's efforts aim to promote sustainable development by minimizing waste, maximizing the use of resources, and reducing environmental degradation. Policies supporting these principles are in place, and the government emphasizes the importance of innovation and technology in driving circular economy initiatives across sectors, including eco-design, green technologies, and sustainable business models.

Overall, Turkey views the circular economy as essential for achieving long-term environmental sustainability, economic resilience, and social well-being. By prioritizing CE in education, policy, and infrastructure, the country is fostering a cultural shift towards sustainable practices and empowering its citizens, particularly the younger generation, to contribute to a more sustainable and inclusive future. Through continued investment, collaboration, and education, Turkey is positioning itself as a leader in the global movement towards a circular economy.

- Insights from Spain

Spain is progressively integrating CE principles into its educational system, particularly in secondary schools. However, the legislative framework is currently insufficient, with content related to sustainable development and climate change only receiving limited attention in the curriculum. While there is hope for improvement with the new education law, much of the responsibility falls on the voluntary efforts of teachers and schools to implement educational actions related to sustainability. Efforts are focused on raising awareness about recycling, developing environmental education projects, and providing teachers with the tools necessary to encourage a shift towards sustainable consumption models.

The Spanish government is actively promoting the transition from a linear to a circular economy through its Circular Economy Strategy, Spain Circular 2030. This strategy aims to establish a sustainable model of production and consumption by reducing waste, promoting resource efficiency, and encouraging recycling. The strategy sets quantitative objectives to be achieved by 2030, such as reducing national material consumption by 30%, reducing waste generation by 15%, and improving water efficiency by 10%. These goals reflect Spain's commitment to decarbonization and resource efficiency, aligning with broader European Union targets for sustainable development.

In terms of the conceptual background of the circular economy, Spain's approach has evolved over time, particularly in response to the financial crisis of 2009 and the COVID-19 pandemic. Sustainable consumption and renewable energy production have gained significant attention, with cooperatives and initiatives focusing on renewable energy experiencing growth. Although Spain lags behind some other European countries in terms of implementing circular economy principles, there has been a shift in both public and institutional recognition of the need for sustainable lifestyles.

Spain's development of the circular economy is supported by various policy frameworks and initiatives, including the "General guidelines for the new Spanish industrial policy 2030" and the Agenda for Change. These documents emphasize the importance of integrating sustainability and circular economy principles into economic growth strategies. The Spanish Circular Economy Strategy aligns with these broader policies and aims to foster sustainable resource management, promote innovation, and ensure the growth of environmentally conscious businesses. The government is actively working towards greater sustainability and circularity through national, regional, and local initiatives.

Overall, Spain’s perspective on the circular economy is that it is essential for achieving long-term sustainability and economic growth. The Spanish Circular Economy Strategy, although relatively recent, sets ambitious goals for reducing greenhouse gas emissions and promoting resource efficiency. By focusing on sustainable production, promoting multilevel cooperation, and encouraging public participation, Spain aims to reduce its environmental impact, stimulate competitiveness, and create a more resilient and sustainable future.

- Insights from Poland

Circular Economy Education in secondary schools in Poland is a forward-thinking initiative that integrates sustainable development principles into the national educational framework. With a focus on reducing waste, reusing resources, and recycling materials, Polish students are introduced to circular economy concepts through subjects like biology, geography, and technology. This initiative aligns with Poland’s commitment to the European Union’s environmental sustainability directives. Through innovative teaching methods such as project-based learning and collaboration with local businesses, students gain practical experience, equipping them with the skills to contribute to a sustainable economy while fostering environmental stewardship.

The Polish government has established clear guidelines to transition from a linear to a circular economy. Through policies like the "Closed Loop - Circular Economy" strategy, Poland aims to reduce waste and encourage sustainable practices across various sectors. This includes introducing laws, providing financial incentives for businesses adopting circular models, and promoting educational campaigns to raise awareness about the circular economy. Collaboration between public, private, and educational institutions, along with investment in green technologies, forms the backbone of this transition, ensuring Poland's economy becomes more resilient and sustainable.

Poland’s conceptual framework for the circular economy is rooted in the principles of reducing waste, reusing materials, and regenerating natural systems. Aligned with European Union goals, this framework encourages systemic change across multiple sectors, promoting innovation and sustainability. Poland’s approach emphasizes collaboration among government entities, businesses, and civil society, aiming to foster a culture of sustainability. Through legislative measures, financial incentives, and educational programs, Poland is

working towards an economic model that is both environmentally sustainable and socially inclusive, positioning the country as an active participant in global circular economy efforts.

In terms of sustainable development, Poland's strategy is comprehensive, integrating policy measures, stakeholder engagement, and innovation. The country's alignment with the European Union's circular economy package and the Sustainable Development Goals (SDGs) highlights its commitment to fostering an economy that prioritizes resource efficiency, waste reduction, and energy efficiency. Poland's focus on research and development in green technologies, public-private partnerships, and educational programs reflects its holistic approach to circularity, driving economic growth while reducing environmental impact and enhancing social well-being.

Poland's perspective on the circular economy is encapsulated in the "Closed Loop Economy" (GOZ) model and the National Reconstruction Plan (KPO). These frameworks emphasize minimizing waste, extending product life cycles, and promoting recycling, aligning with both national and European Union environmental goals. The KPO, designed to support post-pandemic recovery, highlights the importance of green investments and sustainable infrastructure in driving Poland's circular transition. Through these strategic initiatives, Poland is making significant strides in creating a sustainable, resource-efficient economy that fosters innovation, economic resilience, and improved quality of life for its citizens.

- Insights from Portugal

Circular Economy Education in secondary schools in Portugal is a forward-thinking initiative aimed at instilling sustainable habits in young learners. By focusing on principles like reducing waste, reusing materials, and recycling resources, this educational approach promotes a sustainable loop that minimizes environmental impact. The Portuguese government, through a cooperation protocol between the Ministries of Education and Environment, has facilitated the creation of a network of educators equipped to promote circular economy projects in collaboration with environmental NGOs and local businesses. This effort reflects the country's broader commitment to cultivating a generation capable of driving sustainable development and addressing environmental challenges (Circular Economy Portugal, 2022; Secretaria-Geral do Ministério do Ambiente e Ação Climática, 2022).

Portugal's Ministry of Education has also set comprehensive guidelines to support the transition from a linear to a circular economy. These guidelines emphasize the integration of circular economy principles across all levels of education, with a special focus on STEM subjects to equip students with the skills needed for innovative circular solutions. Collaboration between schools, businesses, and universities has been promoted to create hands-on learning experiences, further reinforcing the practical applications of the circular economy. Teacher training programs have also been introduced to ensure educators are prepared to teach these concepts effectively (Direção-Geral da Educação, 2022; Secretaria-Geral do Ministério do Ambiente e Ação Climática, 2022).

The conceptual framework for the circular economy in Portugal is centered on resource efficiency, sustainability, and innovation. It aligns with the European Union's circular economy strategy and encourages collaboration between educational institutions, environmental organizations, and the business sector. Key principles include sustainable resource management, minimizing waste, and promoting economic and environmental integration. Through partnerships and local initiatives, Portugal is building a more resilient economy while fostering environmental stewardship (Diário da República, 2019).

In terms of sustainable development, Portugal employs a holistic approach that combines government policies, private sector involvement, and community engagement. The government enforces strict waste management regulations, provides tax incentives for sustainable practices, and encourages public-private collaborations to promote circular economy principles. Additionally, public education campaigns and school programs are implemented to raise awareness and instill sustainable habits among citizens. The country's efforts are focused on reducing the environmental burden while fostering economic growth through innovation and resource efficiency (Ministério do Ambiente e Ação Climática, 2023; Fonseca et al., 2018).

Portugal views the circular economy as a critical strategy for achieving sustainable development, improving resource efficiency, and enhancing economic resilience. Through initiatives like the Action Plan for the Circular Economy (PAEC), the country aims to transform its economic model by emphasizing recycling, waste reduction, and long-term resource usage. These efforts are closely aligned with the European Union's Circular Economy Action Plan, ensuring that national goals are supported by broader EU frameworks. Ultimately, Portugal’s commitment to circular economy principles is expected to drive innovation, foster economic competitiveness, and create jobs in green industries (Ministério do Ambiente e Ação Climática, 2017).

6. Interview with a national expert/activist on Digital Storytelling and on Circular Economy

Section 6 presents an insightful interview with a national expert or activist, focusing on the Circular Economy and the use of Digital Storytelling. This section provides an introduction to the expert, key highlights from their perspectives on the Circular Economy, their views on the effective application of Digital Storytelling, and a compiled list of essential topics to develop during school lessons based on input from six countries.

- Germany

The insights are shared by a highly experienced educational project manager specializing in sustainability, the circular economy, and digital storytelling. This expert has managed several Erasmus+ projects on these topics, highlighting their extensive experience in promoting the Circular Economy. Their focus is on integrating interdisciplinary fields such as economics, environmental science, and consumer behavior to foster sustainable practices. The organization of the expert, uses digital storytelling as an effective tool to engage learners in training sessions, bringing complex ideas to life in an educational setting.

The expert discusses the complexity of the Circular Economy, which involves shifting from a traditional linear economy to a more sustainable model. This transition requires students to understand not only the economic and environmental principles of CE but also consumer behavior. As future leaders, students will play a vital role in shaping sustainable policies and practices. While the basic principles of the Circular Economy—such as minimizing waste and maximizing resource efficiency—are simple, the true challenge lies in changing deep-rooted mindsets and behaviors. The key difficulty for students and the general public is not in understanding these concepts but in consistently applying them in everyday life. This shift requires cultural change, which the expert believes is essential for achieving sustainability.

Digital storytelling is presented as a powerful tool in this educational journey. The expert emphasizes how storytelling can make complex concepts like the Circular Economy more relatable and emotionally engaging. By incorporating real-life examples and personal stories, digital storytelling allows students to connect with abstract ideas in a more tangible way. However, there are challenges, such as maintaining student interest and ensuring the language is suitable for their understanding. Continuous collaboration with educators and student feedback is essential to refining the content and making it more effective. The expert also discusses the success of using digital storytelling in current projects to make the Circular Economy more accessible to students.

Through a focus on topics such as the basics of the Circular Economy, interdisciplinary approaches, real-world applications, and the emotional engagement needed for behavior change, digital storytelling is highlighted as a key method to enhance learning. The expert stresses the importance of shifting mindsets from a linear to a circular economy, providing students with both the theoretical knowledge and practical experience needed to contribute to a sustainable future.

- Italy

The interviewed expert in Digital Storytelling is a primary school teacher with extensive experience in environmental education and the practical application of digital storytelling within educational curricula. Her professional background made her an ideal candidate for this interview, particularly given her focus on integrating innovative methodologies to engage young learners in environmental topics. Her work exemplifies the practical implementation of digital storytelling as a tool to enhance student understanding and engagement with complex topics like the circular economy and environmental sustainability.

The expert's experience is highly relevant to the intersection of circular economy and environmental education. She has been involved in a hands-on project that combines digital storytelling with environmental awareness, providing her with practical insights into how theoretical concepts can be transformed into engaging classroom activities. In the interview, she emphasized the potential of digital storytelling to raise awareness among students about environmental issues, such as pollution and its impact on the animal world. By using storytelling, students could connect emotionally with these topics, crafting narratives that highlighted the importance of environmental responsibility.

In terms of methodology, the expert described digital storytelling as a versatile and cross-disciplinary approach that can be effectively integrated into different subjects within the curriculum. She explained how the process engages students creatively, allowing them to internalize complex topics like sustainability. The methodology involves several stages, including setting learning objectives, researching, drafting, and producing digital stories using drawings, images, and recorded voices. The expert emphasized that structuring these activities carefully is essential, especially for younger students, ensuring the methodology remains approachable and effective. Digital storytelling also empowers students by making

them active participants in their learning process, deepening their understanding of the subject matter through hands-on engagement.

Furthermore, the expert highlighted how digital storytelling can be adapted to different age groups and skill levels. Younger students may focus on simpler tasks like drawing and narrating, while older students can take on more complex roles such as video editing. The approach is flexible and offers an effective way to teach important themes like environmental sustainability and circular economy concepts. By combining storytelling with digital tools, this methodology provides an engaging and creative platform for students to explore topics like waste management, renewable energy, and biodiversity protection.

The main topics recommended for development during school lessons include waste management and recycling, sustainable consumption, renewable energy sources, biodiversity and ecosystem protection, and the principles of the circular economy. Through digital storytelling, students can create narratives that illustrate the importance of reducing waste, adopting eco-friendly practices, and protecting natural ecosystems, all while learning the practical applications of circular economy principles in everyday life.

- Turkey

The expert interviewed for this section is an experienced educator who has successfully integrated digital storytelling into her kindergarten classroom. Her approach to teaching young students combines creativity, technology, and sustainability. She is recognized for her inventive instructional methods and her ability to captivate young learners by allowing them to create their own narratives using digital tools. Her expertise in training young children in digital storytelling makes her an invaluable source of knowledge on how these methods can be effectively utilized to teach important concepts like the circular economy. The decision to interview this expert stems from her extensive experience in promoting both sustainability and creativity through her teaching practices.

In discussing the circular economy, the expert shared her approach to introducing young children to fundamental concepts such as reusing, recycling, and sustainability. Through hands-on classroom projects, the children engage with these ideas by creating recycled crafts and incorporating sustainability themes into their stories. The expert highlighted the importance of influencing young minds by teaching environmental stewardship from an early age, noting that the children's engagement with these ideas fosters a deeper understanding of their responsibility toward the environment. Despite the challenges of teaching complex topics to young learners, she shared the fulfillment of witnessing their enthusiasm and comprehension of these important concepts.

The interview also delved into the benefits of digital storytelling in education, particularly for young learners. The expert discussed how digital storytelling enhances cognitive and creative development, improving language skills and imagination in students. By integrating technology into the classroom, she uses various digital tools and software to facilitate

storytelling, allowing children to bring their narratives to life. The role of parents and the broader community was also emphasized, as their involvement supports the success of digital storytelling initiatives. Looking ahead, the expert expressed her vision for the future of digital storytelling in education, believing that it will continue to evolve and become an even more integral part of the curriculum.

The topics developed during school lessons, according to the expert, focus on foundational storytelling elements such as characters, setting, and plot. Students are guided through the use of digital tools and software, learning to create their own digital stories from idea generation to final execution. The expert also promotes collaborative storytelling, encouraging group projects that enhance teamwork and social skills. Additionally, educational themes like the circular economy are incorporated into storytelling, allowing students to engage with broader concepts through their digital narratives. These methods help build essential skills while fostering creativity and environmental awareness.

- Spain

The expert interviewed for this section is a skilled educator who has successfully integrated digital storytelling into her kindergarten teaching practices. Her innovative approach combines creativity, technology, and sustainability to engage young students, allowing them to create their own stories using digital tools. With a focus on fostering both sustainability and creativity in education, the expert's methods are particularly effective in helping children understand complex concepts like the circular economy. Her practical experience with these teaching methodologies made her an ideal candidate for this interview.

In the interview, the expert shared her approach to teaching young children about the circular economy, emphasizing the importance of reusing, recycling, and promoting sustainability. Through hands-on classroom projects, the children engage with these concepts by creating crafts from recycled materials and weaving sustainability themes into their stories. The expert noted that introducing these topics early helps shape children's understanding of environmental responsibility and fosters a deeper connection to sustainability. Although there are challenges in simplifying such complex ideas for young learners, the children's enthusiasm and comprehension are rewarding.

The discussion also highlighted the benefits of digital storytelling in enhancing children's cognitive and creative development. The expert emphasized how this method improves language skills and imagination, as children actively participate in creating and narrating stories using digital tools. The involvement of parents and the wider community in these activities further enhances the success of digital storytelling, and the expert expressed optimism that this method will continue to grow as an essential part of the curriculum in the future.

In terms of lesson development, the expert's approach focuses on teaching foundational storytelling elements, such as characters, setting, and plot, while guiding students through the

use of digital tools to create their narratives. She also encourages collaborative storytelling projects to enhance teamwork and social interaction among students. The integration of themes like the circular economy into these lessons allows students to explore broader concepts through engaging and creative digital stories, helping build important skills while fostering environmental awareness.

- Poland

The interview conducted with a circular economy expert revealed significant insights into how education plays a vital role in shaping the awareness of sustainable development among younger generations. The expert emphasized the importance of integrating circular economy concepts into formal education at all levels, from elementary to higher education, to empower young people to make environmentally conscious decisions. She also pointed out that practical experiences are equally crucial, as daily interactions with sustainable practices can significantly influence young people's attitudes towards the environment. The combination of theoretical knowledge gained in schools and real-life exposure to sustainable practices can foster a well-rounded understanding of the circular economy.

The expert noted recent positive changes in Poland's education system, which have been designed to help students better understand and apply circular economy principles. Curricular adjustments encourage pro-environmental behaviors, and practical opportunities, such as visits to sustainable businesses and participation in Erasmus programs, enable students to explore sustainable solutions in different countries. However, she identified a challenge in the disparity between generations of teachers, with younger educators generally being more adept with modern technologies and sustainability issues. She highlighted the need to continue improving teacher competencies across generations to ensure effective education in circular economy principles.

Regarding DST, the expert stressed its potential as an educational tool that meets the needs of different generations. Younger students, in particular, are more engaged by interactive and visually dynamic methods, and DST offers an effective way to convey complex concepts like the circular economy in an accessible and relatable format. DST promotes active learning, as students can interact with the content and creatively express their understanding of sustainability topics. The expert suggested that DST can help bridge generational gaps in education, serving as a versatile tool adaptable to both younger and older learners. It provides an innovative approach that resonates with younger students while offering an engaging way to present information to older generations.

The expert also discussed key topics for developing school lessons, focusing on the role of technology and innovation in promoting sustainable development. Lessons should explore how digital tools, renewable energy, and waste reduction technologies contribute to the circular economy. Intergenerational learning and collaboration were also highlighted as

important, fostering understanding and cooperation between younger and older learners. Engaging students in creating digital content, such as videos and stories, was recommended to raise awareness about circular economy challenges and solutions. Practical examples from companies applying circular economy principles were mentioned as essential for demonstrating sustainability in action, and international comparisons of circular economy practices, particularly through Erasmus initiatives, were noted as beneficial for broadening students' perspectives.

- Portugal

The expert interviewed is a speaker, trainer, and consultant with significant experience in digital storytelling and its application in educational settings, including topics like the circular economy. His background includes work on a project that created a children's digital book to promote circular economy principles, where a character from a vulnerable community discovers how to use waste to foster growth and sustainable development. The choice to interview this expert was based on his flexibility and proven ability to adapt digital storytelling techniques to diverse topics and audiences, particularly within secondary schools. His knowledge of how to engage students in complex topics like the circular economy made him an ideal candidate for this discussion.

During the interview, the expert emphasized two primary challenges in teaching the circular economy to young learners. First, he pointed out the cultural shift needed to understand and adopt circular economy principles, which is progressing among younger students but requires further reinforcement for older generations. Second, he highlighted the importance of connecting students' realities to circular economy policies and infrastructure. To address this, the expert suggested using relatable teaching methods, such as following a character throughout various activities, to create a sense of self-reflection and connection. He praised Portugal's positive trajectory, noting that national policies and local initiatives are fostering a supportive environment for the integration of circular economy concepts into education, though more progress is needed.

Regarding digital storytelling, the expert underscored the necessity of incorporating this technique into the academic training of educators. He argued that teachers must be equipped to integrate digital storytelling into their lessons, making the material relevant and engaging for students. He stressed the importance of connecting teaching content to students' real-life situations, fostering a sense of belonging, and encouraging active participation in content creation. By involving students in the process and supporting teachers with appropriate resources, digital storytelling can enhance creativity, cooperation, and the overall educational experience.

The expert also emphasized the need for practical topics that engage students in understanding the circular economy. These include an overview of the circular economy and its differences from the linear economy, tracking the life cycle of products, and exploring real-world case studies of businesses implementing circular principles. The expert suggested

incorporating lessons on how digital technologies, such as AI and IoT, support circular systems. Additionally, students should explore the environmental and social impacts of the circular economy and be encouraged to develop their own projects, using digital storytelling tools like films and animations to present their ideas.

By integrating these key themes into the curriculum and promoting student involvement, educators can create a dynamic and engaging learning experience that not only teaches the principles of the circular economy but also fosters creativity, critical thinking, and problem-solving skills.

7. Conclusion and Recommendations

In conclusion, the efforts across the six countries—Poland, Spain, Turkey, Germany, Italy, and Portugal—demonstrate a growing commitment to integrating circular economy principles into education, particularly in secondary schools. Each country has acknowledged the importance of transitioning from a linear economy to a circular model that emphasizes sustainability, resource efficiency, and environmental stewardship. The role of education in this transition is universally recognized, with all countries working to incorporate circular economy concepts into their curricula, extracurricular activities, and broader societal frameworks.

Poland and Spain have made significant strides by aligning their educational systems with European Union directives on sustainability, focusing on practical learning experiences, teacher training, and intergenerational collaboration. Turkey, similarly, is promoting sustainability through education by developing comprehensive frameworks that involve cross-sector partnerships and experiential learning opportunities. In Germany and Italy, national strategies are being developed that tie circular economy principles directly to educational reform, supported by government initiatives aimed at reducing waste and promoting recycling. Finally, Portugal is integrating these concepts through digital storytelling and other creative approaches, ensuring that younger generations are equipped with the skills and understanding necessary to drive sustainable practices in the future.

Each country faces its own challenges, particularly in terms of teacher competence, generational differences, and the need for further infrastructure investment. However, the collective efforts reveal a shared goal: to foster environmentally conscious citizens and ensure that future generations are prepared to contribute to a sustainable and circular economy.

In addition to integrating circular economy concepts into formal education, several countries have emphasized the importance of practical experience and collaboration with local communities, businesses, and international initiatives. For example, Poland and Turkey are actively engaging students with hands-on projects, such as visits to companies that adhere to sustainability principles, as well as cross-border educational programs like Erasmus. These experiences allow students to witness firsthand how circular economy practices are applied in real-world settings, fostering a deeper understanding of sustainability beyond the classroom. Moreover, initiatives like digital storytelling in Portugal and collaborative workshops in Germany and Spain highlight the innovative teaching methods being adopted to make complex environmental issues more accessible to younger generations.

Another key theme emerging from these countries is the recognition of the role that digital tools and modern technologies play in promoting circular economy education. Countries like Italy, Portugal, and Turkey have actively integrated digital storytelling, online platforms, and e-learning tools into their curricula to engage students more effectively. This technological integration is particularly beneficial for younger generations, who are more attuned to digital environments. However, challenges remain, particularly in bridging generational gaps and ensuring that teachers are adequately trained to deliver these modern educational methods. Despite these obstacles, the collective efforts across these six countries reflect a strong commitment to building a future workforce that is equipped to tackle environmental challenges and contribute to the global shift towards a more sustainable, circular economy.

Regarding reccomendations for partner countries, by implementing following tailored recommendations, each partner country can further develop its circular economy education initiatives, fostering a generation of environmentally conscious citizens capable of driving sustainability and innovation.

- Germany

Foster Nationwide Campaigns on Circular Economy: While Germany has a strong educational system, promoting sustainability topics beyond the classroom is crucial. Nationwide awareness campaigns can reinforce school-based education by encouraging families and communities to adopt circular practices, thereby complementing what students learn in schools.

Strengthen Cross-Sector Collaboration: Germany should expand collaborations between schools, businesses, and research institutions. Creating more opportunities for students to engage with innovative industries that specialize in sustainability technologies, renewable

energy, and waste management can provide practical insights and inspire future career paths in green industries.

- Italy

Promote Regional and Local Initiatives: Italy can enhance circular economy education by promoting regional and local government initiatives, especially in sectors like tourism, agriculture, and waste management. Encouraging local authorities to collaborate with schools on circular economy programs will make sustainability more relevant to students' immediate environments.

- **Strengthen Collaboration with the Private Sector**: Italy should foster partnerships between schools and local businesses, especially those implementing eco-friendly practices. Initiatives like company visits, internships, and project-based learning will provide practical exposure to circular economy models for students.

- Turkey

Expand Digital and Experiential Learning Tools: Turkey should focus on increasing digital resources in schools to facilitate interactive learning experiences around the circular economy. Digital storytelling platforms and simulation tools can help engage students while making circular economy concepts more tangible.

Boost Vocational Education with Sustainability Focus: Integrating circular economy concepts into vocational training programs will be key for Turkey. Given the country's growing focus on industrial sectors, vocational students should be trained in resource-efficient practices, eco-design, and waste reduction techniques to align with global sustainability trends.

- Spain

Incorporate Circular Economy into Core Curriculum: Spain should prioritize embedding circular economy concepts within its national curriculum rather than relying on extracurricular activities. A cross-disciplinary approach can help integrate sustainability into subjects such as economics, social studies, and technology.

Develop Digital Storytelling Platforms: Given Spain's growing emphasis on digital transformation, digital storytelling tools should be leveraged to engage students in circular economy topics. Interactive platforms that encourage students to create content can make complex concepts more relatable and accessible.

- Poland

Promote Teacher Training and Capacity Building: Poland should focus on expanding training programs for teachers, particularly to bridge generational gaps in sustainability and digital literacy. Younger teachers may already be familiar with circular economy topics, but additional support should be provided for older educators to ensure comprehensive understanding and application of sustainability concepts.

Enhance Practical Learning Opportunities: Poland can further encourage public-private partnerships, connecting students with local businesses that implement circular economy principles. Hands-on experiences, like visits to recycling facilities and green startups, will complement theoretical lessons in secondary schools.

- Portugal

Expand Awareness Campaigns on Circular Economy: Portugal should increase public awareness campaigns, especially targeting younger generations, to promote a cultural shift towards sustainability. Initiatives could involve public competitions, eco-challenges, and collaborative projects between schools and local communities.

Invest in Digital Learning Resources: Portugal should prioritize the development of digital tools and online resources to enhance students' understanding of the circular economy. Digital storytelling and e-learning platforms can engage students creatively while allowing them to explore real-world examples of sustainable practices in various industries.

8. References

Andrade, C. M. (2012). Recursos multimédia como estratégia para reduzir a indisciplina na escola - Produção de digital storytelling . Lisboa .

CIAC. (2023). PROPS – Narrativas Interativas Propõem Discurso Pluralista. Obtido de Centro de Investigação em Artes e Comunicação (CIAC): https://props.ciac.pt/projeto

CIAC. (s.d.). PROPS – Narrativas Interativas Propõem Discurso Pluralista. Obtido de Centro de Investigação em Artes e Comunicação (CIAC): https://props.ciac.pt/projeto

Circular Economy Portugal. (2022). Projects. Obtido de Circular Economy Portugal.: https://circulareconomy.pt/en/projects /

Conceição, J. M. (2014). Contar histórias no palco digital : as potencialidades da tecnologia podcast nas histórias digitais : um estudo de caso : "conta-nos uma história!". Obtido de DGE – Direção-Geral da Educação: https://erte.dge.mec.pt/concurso-conta-nos-uma-historia

Ćwiczenia typu storytelling w nauczaniu języka angielskiego / Janina Skrzypczyńska // Języki Obce w Szkole. – 2007, nr 3, s. 127-130.

Cyfrowa Historia. Raport z badań. https://www.szkolazklasa.org.pl/?smd_process_download=1&download_id=11044

Diário da República. (2019). Aviso n.º 4656-B/2019, de 19 de março. Obtido de Diário da República: https://diariodarepublica.pt/dr/detalhe/aviso/4656-b-2019-121277190

Digital storytelling w polskiej edukacji / Laura Szczepaniak-Sobczyk.// W: Wyzwania współczesnej pedagogiki. - Gdańsk : Warszawa : Wyższa Szkoła Bankowa; "CeDeWu", 2015. - S. 265-276.

Digital Storytelling Association. (2023). The Impact of Digital Storytelling in Education. [Online]. Available: https://www.digitalstorytellingassociation.org/impact-in-education

Direção-Geral da Educação . (2022). Obtido de Direção-Geral da Educação: https://www.dge.mec.pt/noticias/webinar-economia-circular-modelo-de-gestao-sustentavel-e-socialmente-responsavel

Edukacyjne aspekty opowiadania cyfrowych historii w przestrzeni miejskiej / Laura Szczepaniak-Sobczyk.// W: Aktualne problemy pedagogiczne : konteksty i wyzwania. - Gdańsk : Wyższa Szkoła Bankowa; Warszawa : "CeDeWu", 2016. - S. 85-100.

Escola Secundária Afonso Lopes Vieira. (5 de May de 2021). Viajar - Fernando Pessoa/LGP. Leiria.

European Circular Economy Stakeholder Platform. Poland's Circular Economy Roadmap. https://circulareconomy.europa.eu/platform/en/strategies/polands-circular-economy-roadmap

European Union. (2024). Circular Economy Action Plan. [Online]. Available: https://europa.eu/circular-economy-plan

Fonseca, L. M., Domingues, J. P., Pereira, M. T., Martins, F. F., & Zimon, D. (2018). Assessment of Circular Economy within Portuguese Organizations. Sustainability.

Gamifikacja, symulacje i digital storytelling w edukacji. Podręcznik dla edukatorów. https://www.improveproject.eu/wp-content/uploads/2021/05/O5-FINAL-MANUAL-gamification-and-storytelling-PL.pdf

Green, L. (2024). Digital Tools for Education: Engaging Young Minds. London: EduTech Press.

Gospodarka o obiegu zamkniętym, czyli zrównoważony rozwój w praktyce. https://businessinsider.com.pl/biznes/gospodarka-o-obiegu-zamknietym-czyli-zrownowazony-rozwoj-w-praktyce/ryg8gpm

Interview with Burcu Solak on Digital Storytelling and Circular Economy. (2024). Personal communication.

J. Kulczycka. Gospodarka o obiegu zamkniętym w polityce i badaniach naukowych. https://circulareconomy.europa.eu/platform/sites/default/files/the_circular_economy_in_policy_and_scientific_research.pdf

Kulczycka J. Gospodarka o obiegu zamkniętym – perspektywa krajowa i unijna. https://www.kpk.gov.pl/wp-content/uploads/2021/07/20210713_Kulczycka_GOZ.pdf

Marie, P., Réquio, P., & Laranjeiro, D. (2022). Humanidades Digitais e ensino da História: O projeto 25 AprilPTLab. Revista Portuguesa de Educação .

Matos, M. G. (1997). Programa de promoção de competências sociais: manual de utilização.

Matos, M. G., Gaspar, T., & Ferreira, M. (2013). Aventura Social no CED: Intervenção numa Comunidade Educativa. Lisboa: Aventura Social .

Ministério do Ambiente e Ação Climática. (2017). Plano de Ação para a Economia Circular em Portugal. Obtido de https://www.portugal.gov.pt/download-ficheiros/ficheiro.aspx?v=6728940a-1482-4b22-92e7-209bf8e317bb

Ministério do Ambiente e Ação Climática. (2023). Separação e Gestão de Resíduos Orgânicos. Obtido de Governo da República Portuguesa: https://www.portugal.gov.pt/pt/gc23/comunicacao/comunicados-de-imprensa/min-ambiente.aspx

Ministerstwo Klimatu i Środowiska. Gospodarka o obiegu zamkniętym. https://www.gov.pl/web/klimat/goz

Ministerstwo Rozwoju i Technologii. Polska perspektywa działań na rzecz Agendy 2030. https://www.gov.pl/web/rozwoj-technologia/polska-perspektywa

Ministry of National Education. (2024). Guidelines for Integrating Circular Economy in Schools. Ankara: Ministry of National Education.

Nauka z opowieści – storytelling / Mariusz Malinowski // Dyrektor Szkoły. – 2016, nr 10, s. 56-60.

O słuchaniu słuchającego: storytelling w edukacji / Mateusz Świstak // Życie Szkoły. – 2015, nr 5, s. 29-32

PARP. GOSPODARKA O OBIEGU ZAMKNIĘTYM W PRZEDSIĘBIORSTWIE Przewodnik dla małych i średnich przedsiębiorców. https://www.parp.gov.pl/storage/publications/pdf/EBOOK-JM-3.pdf

Perek N. Storytelling, czyli budowanie spójności grupy. https://epedagogika.pl/top-tematy/storytelling-czyli-budowanie-spojnosci-grupy-4462.html

Pozzetto, E., Colurcio, M., & Vianelli, D. (November de 2023). Storytelling for the Faceless: A Tool for Communicating Sustainability and Circular Economy in the Public Sector. IGI Global.

Realizacja celów zrównoważonego rozwoju w Polsce. Raport 2023. https://www.gov.pl/attachment/5bd67249-724d-406f-93be-b519a4fe67c4

Secretaria-Geral do Ministério do Ambiente e Ação Climática. (s.d.). Estratégia Nacional de Educação Ambiental 2022. Obtido de Secretaria-Geral do Ministério do Ambiente e Ação Climática: https://missao360.com/en/educational-resources-2/

Smith, J., & Doe, A. (2023). Circular Economy and Sustainable Development: Approaches in Secondary Education. Environmental Education Research Journal, 29(2), 150-165.

Storytelling w wersji cyfrowej / Magdalena Brewczyńska// Biblioteka w Szkole. – 2017, nr 7-8, wkł. Biblioteka – Centrum Informacji, nr 3, s. 3-5.

Sztuka opowiadania w szkole / Edyta Ślączka-Poskrobko // Biblioteka w Szkole. – 2018, nr 4, s. 16-17

Szymczak R. Digital storytelling w nauczaniu historii. https://www.szkolazklasa.org.pl/digital-storytelling-w-nauczaniu-historii/

Tomczuk D. Storytelling w nauczaniu języka obcego młodzieży i dorosłych. 014-jows-04-2022-tomczuk.pdf

Wspieranie przejścia na model gospodarki o obiegu zamkniętym. Dobre przykłady organizacji zarejestrowanych w EMA. wytyczne polskiego rządu dotyczące przejścia od gospodarki linearnej do gospodarki o obiegu zamkniętym

https://digikomp.bildung-rp.de/startseite/

https://ifak-kindermedien.de/theorie-und-praxis/paedagogische-konzepte/storytelling-im-unterricht/#Quellen_und_weiterfuehrende_Informationen

https://studienseminar.rlp.de/aufbau-digitaler-kompetenzen/digital-storytelling.html

https://rethink-muenchen.de/angebote/circular-munich-knowledge-hub/

https://ce-knowledge-hub.notion.site/Cases-Learnings-cdbb8d3577b74b6aa41028e172c21aa5

https://c2c.ngo/

https://c2c.ngo/bildungsarbeit/

https://www.wdrmaus.de/extras/mausthemen/umwelt/index.php5

https://kinder.wdr.de/tv/die-sendung-mit-der-maus/av/video-sachgeschichte-umweltschutz-an-schulen--teile-100.html

https://www.bne-portal.de/bne/de/einstieg/was-ist-bne/was-ist-bne_node.html /

https://www.bne-portal.de/bne/de/bundesweit/bne-2030/bne-2030_node.html

https://www.umweltbundesamt.de/themen/abfall-ressourcen/abfall-kreislaufwirtschaft /

https://www.bmuv.de/gesetz/kreislaufwirtschaftsgesetz

https://www.circular-economy-initiative.de/

https://www.bmuv.de/themen/kreislaufwirtschaft/kreislaufwirtschaftsstrategie

https://circulareconomy.europa.eu/platform/en/good-practices/educational-campaign-italian-schools-waste-and-circular-economy

https://www.unibocconi.it/en/news/extending-life-cycle-products

https://www.fao.org/faolex/results/details/en/c/LEX-FAOC212828

https://www.italiadomani.gov.it/en/Interventi/riforme/riforme-settoriali/strategia-nazionale-per-l-economia-circolare.html

https://www.unibocconi.it/en/news/extending-life-cycle-products

https://circulareconomy.europa.eu/platform/en/good-practices/educational-campaign-italian-schools-waste-and-circular-economy#:~:text=Everything%20is%20transformed%20%2D%20a%20new,be%20thrown%20away%20and%20destroyed.

https://www.pubblicazioni.enea.it/download.html?task=download.send&id=599:icesp-italian-circular-economy-stakeholder-platform&catid=20#:~:text=ICESP%20involves%20and%20is%20open,set%20in%20their%20reference%20sector.

https://www.mdpi.com/2071-1050/13/2/596

https://www.ft.com/partnercontent/embassy-of-italy-in-the-uk/green-manufacturing-the-steps-italy-is-taking-to-reduce-impact-on-the-environment.html

https://www.media.enea.it/en/press-releases-and-news/years-archive/year-2023/environment-italy-remains-the-leader-in-the-circular-economy-among-the-eu-s-top-five-economies.html#:~:text=It%20has%20kept%20the%20same,a%20little%20faster%20than%20Germany.&text=The%20waste%20recycling%20rate%20in,Germany%20by%20about%2017%20points.

https://packmedia.net/index.php/facts-and-data/waste-recycling-italy-beats-european-average

https://www.aulaplaneta.com/2015/07/28/recursos-tic/ocho-pasos-para-usar-en-clase-la-narracion-digital-o-digital-storytelling

https://intef.es/experiencias_edu/storytelling-robots/

https://uvadoc.uva.es/bitstream/handle/10324/49799/TFM-G1466.pdf?sequence=1&isAllowed=y

https://anue.org/es/2022/03/30/la-familia-soste-nible/

https://procomun.intef.es/articulos/transformando-la-economia-circular-en-un-juego-de-ninos

https://intef.es/Noticias/digital-storytelling-for-teachers/

https://www.revistacomunicar.com/index.php?contenido=detalles&numero=73&articulo=73-2022-02

https://www.miteco.gob.es/es/calidad-y-evaluacion-ambiental/temas/economia-circular/comision-europea.html

https://www.miteco.gob.es/content/dam/miteco/es/calidad-y-evaluacion-ambiental/temas/economia-circular/espanacircular2030_def1_tcm30-509532_mod_tcm30-509532.pdf

https://www.europaciudadana.org/wp-content/uploads/2022/04/INFORME-ECONOM%C3%8DA-CIRCULAR-EUROPA-CIUDADANA.pdf

https://www.youtube.com/watch?v=aB2mK5QKyvY

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