



The Pollicina Project: A Collaborative and Educational Social Suite to Build Cultural Itineraries

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Abstract. The Pollicina project is aimed at defining a collaborative coordinated learning environment, called Educational Social Network, to allow students to elaborate thematic cultural paths on the territory. The topic is addressed with the “flipped learning” methodology where the socialization aspect assumes a key role in the learning process: students can collaborate and share knowledge and their assessment is obtained as an aggregation of formal (i.e., grades) and informal activities (i.e., soft skills). The starting phase of the project consists in defining a common semantic schema of the heterogeneous material in order to facilitate the work of students when they access to the Educational Social Network. The Pollicina’s e-learning platform presents several innovative services to build the customized itineraries according to the track defined by the teacher, e.g. the “ArtTour” service dedicated to the definition of the cultural paths, the “Magazine” service to collect the most interesting cultural itineraries, etc. The first one is the “Data Filling” service where students have to complete, in a collaborative way, the information of the cultural heritage objects provided by the cultural institutions (museums, churches, archaeological sites, etc.) joined to Pollicina.

Keywords: Education 3.0 · Flipped learning · Art and Teaching · Cultural heritage

1 Introduction

The goal of the Pollicina project (Calegari et al. 2017) is to build a collaborative coordinated social learning environment which allows to create knowledge itineraries and to bring the students closer to cultural heritages (museums, churches, archaeological sites, etc.).

The mission is to obtain an active participation in the cultural life; the younger users will approach the historical and cultural topics through direct involvement in pleasurable activities in order to share experiences and ideas. Collaborative teaching among peer groups can induce synergy for the active production of the paths. These are created according to the indications of teachers and experts of cultural institutions establishing a novel form of social learning dedicated to the art topic. Students can also enrich the

heterogeneous material (e.g., paintings, archaeological finds, statues, etc.) provided by the cultural heritage institutions that joined the project.

These paths are defined with the help of a recommendation system that suggests alternative paths based both on the location of the material inside the museum, and on the semantic correlation between the materials. This approach falls within the concept of Education 3.0 according to which the contents are proposed and articulated through interactive social channels, and they are processed by students in a collaborative way. In Pollicina, we are developing a learning environment called EduSN (Educational Social Network) to support collaborative teaching. EduSN is a Social LMS (Learning Management System) that integrates social networking, collaboration and knowledge sharing capabilities, as well as interactive elements that enable users to rate contents. These objectives are achieved by integrating aspects of a CMS (Content Management System) for the classification of the material, and of an Enterprise Social Network (for collaborative work) with a strong emphasis on the social aspects to extend the standard LMS platforms. EduSN is equipped with a dashboard to evaluate the itineraries created, both for teachers who propose the guidelines, and for the peers themselves who can use these itineraries to get closer to new cultural heritage according to the proposed topic. To support the visit to the cultural heritage sites, a geo-referenced system is defined with the intent to realize an augmented visit by providing more details on the materials.

As a result, it is possible to produce complex itineraries which include several cultural institutions, like museums, archaeological sites and churches. These itineraries will be reusable by the cultural institutions as a mean to promote their activities, attract more users, encourage a more flexible and collaborative use of the collections.

The paper is organized as follows. Section 2 presents an overview of the Pollicina project, Sect. 3 gives a panoramic of the EduSN's architecture, Sect. 4 defines the strategy adopted to represent the data model of the cultural material, Sect. 5 proposes the "Data Filling", the first service of our e-learning platform. Finally, some conclusions are presented.

2 A Brief Presentation of the Pollicina Project

The Pollicina project (<https://www.progettopollicina.eu>) follows the "flipped learning" paradigm (Filiz and Kurt 2015; Dalsgaard 2006; Michael 2006), where the use of technology supports the learning practices in order to: (1) stimulate the creation of learning communities - students can take notes and share their experience, (2) collaborative learning - students can improve their skills on the course/topic, interacting with colleagues and experts anywhere and anytime, (3) the adoption of new workspaces - students and teachers can join to virtual work areas to share projects, ideas, etc. A collaborative virtual work space leads the student to obtain greater cognitive awareness and increases self-esteem. Furthermore, the identification of the expert (Avogadro et al. 2016) plays a key role in the paradigm of "flipped learning"; indeed, the expert helps peers within the learning communities (Herling 2000). Figure 1(a) shows some learning features, in detail:

- Revision, students can check the work performed by peers in a collaborative way. The teacher supervises and comments the learning activities;
- Soft Skill, students are evaluated by the teacher according to their social capabilities;
- Role, students can have different responsibilities during a task in order to acquire learning awareness and improve their self-esteem;
- Multimedia, the tasks are performed thanks to the use of technologies such as smartphones, tablets, etc.; in addition, students can enrich the knowledge of each cultural heritage object with movies, pictures, musics during the definition of their cultural paths.

Figure 1(b) presents the logical division of the students in small groups where the members of each group collaborate and share knowledge to solve the task defined by the teacher. In the figure, we refer to a class that logically can be organized in groups, but in the flipped learning context the design can be extended to the concept of a large group (i.e., students who belong to different classes or schools, thus not only members of a single class) that can be aggregated in groups independent of their origin.

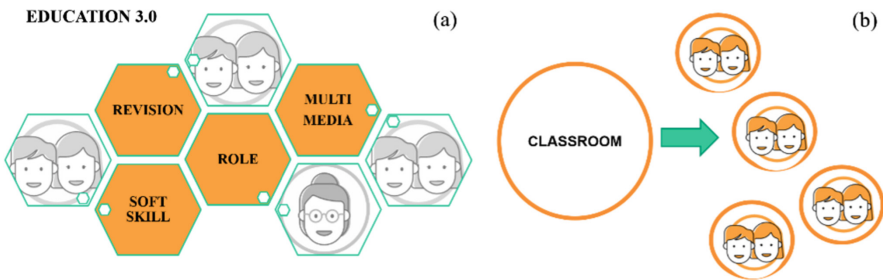


Fig. 1. Pollicina's elements: (a) social features, and (b) working groups.

The Pollicina project involves students starting from the primary school level, up to secondary schools, including the “alternanza scuola lavoro” (i.e., an Italian teaching method created in collaboration between schools and companies to offer students skills that can be used in the job market), in which the approach to cultural heritage can be translated into a moment of collective and individual cultural and emotional training. In this way, it is possible to achieve an active participation to the cultural life, which is suitable to the educational level of the groups. Younger users can approach the historical-cultural themes through a direct involvement in amusing activities that convey a reasoned learning of the contents according to a gamification paradigm. To achieve this goal, different methodological and technological approaches are used. In the first phase, the project involves 12 heterogeneous schools of all educational levels, for a total of about 900 users. There are 26 cultural institutions involved in the

Lombardy region. Approximately 300 secondary school students are involved in “alternanza scuola lavoro” activities, including aspects of user centred design. With the new academic year, we plan to enlarge the audience of users (both schools and cultural institutions), and to complete the development of the whole EduSN’s features.

3 The Educational Social Network

The goal of Pollicina is to define an innovative Educational Social Network (EduSN), that combines standard aspects of an e-learning environment with social networking, collaboration and knowledge sharing capabilities, as well as interactive elements that enable users to rate contents. EduSN is developed as SaaS (software as a service) for giving the possibility of groups of students to elaborate the lessons anywhere and anytime. This section gives an overview of the architecture underlining the EduSN (see Fig. 2); it is important to stress that our architecture follows the principle of micro-services, namely each service is an independent component that can be integrated in other platforms according to a few modifications related to the APIs aspects. In the starting phase of the project, we have conducted a survey by analyzing the existing opensource e-learning platforms not only as a baseline for our development but also to understand the motivations of a possible integration. To this aims, a deep analysis has been made with Moodle, and after a preliminary integration we understood that our EduSN presents a lot of innovative services and user’s requirements. The outcome is that no integration with other e-learning tools can be possible for the Pollicina’s objectives.

The data are provided by heterogeneous sources of information and this increases the complexity of the ETL (Extraction, Transformation, Process) process aimed at defining common schemas of the meta-data according to the specific EduSN’s service that has to be invoked according to the user’s request. In detail, the storage level collects the following information: (1) Social LMS (Social Learning Management System), it considers all the users’ activities related to the ability to collaborate and share information to solve a task such as the information generates within a social wall, concurrent editing, comments, chat, etc.; (2) VLE (Virtual Learning Environment), it implicitly monitors the user’s actions during his/her interaction with EduSN, for example, the material printed, saved, downloaded, viewed (video, images, texts), etc.; (3) Student Information System, it considers scholastic information related to a student such as ID number, formal grades, class and school to which he/she belongs, etc.; (4) Cultural Heritage Information, it stores the knowledge provided by the cultural institutions which have joined to Pollicina (for more details see Sect. 4). The “Learning Records Warehouse” component stores the knowledge acquired by the storage level within ad-hoc data structure/format as result of the ETL process.

The data elaborated are then used by ad-hoc methodologies, in detail: (1) Flipped Learning, the students are organized within editorial committees, and they have a specific role in the creation process of the itinerary. In detail, Pollicina adopts a *student-centered approach*, where students become engaged in “active learning” where a lesson goes beyond a passive listening and students elaborate the learning tasks starting

from elementary materials and the guidelines from the teacher. (2) Gamification, the students’ activities are monitored to assign the relative badge according to communication skills, interpersonal skills, problem solving capabilities, interaction with peers and leadership skills. (3) Recommender System, the user profile is analysed to find peers with similar interests in order to suggest useful learning materials (Re Depaolini et al. 2018). (4) Classification System, the definition of a novel algorithm of soft clustering (ref Vietnam) to mine data according to the user’s information needs.

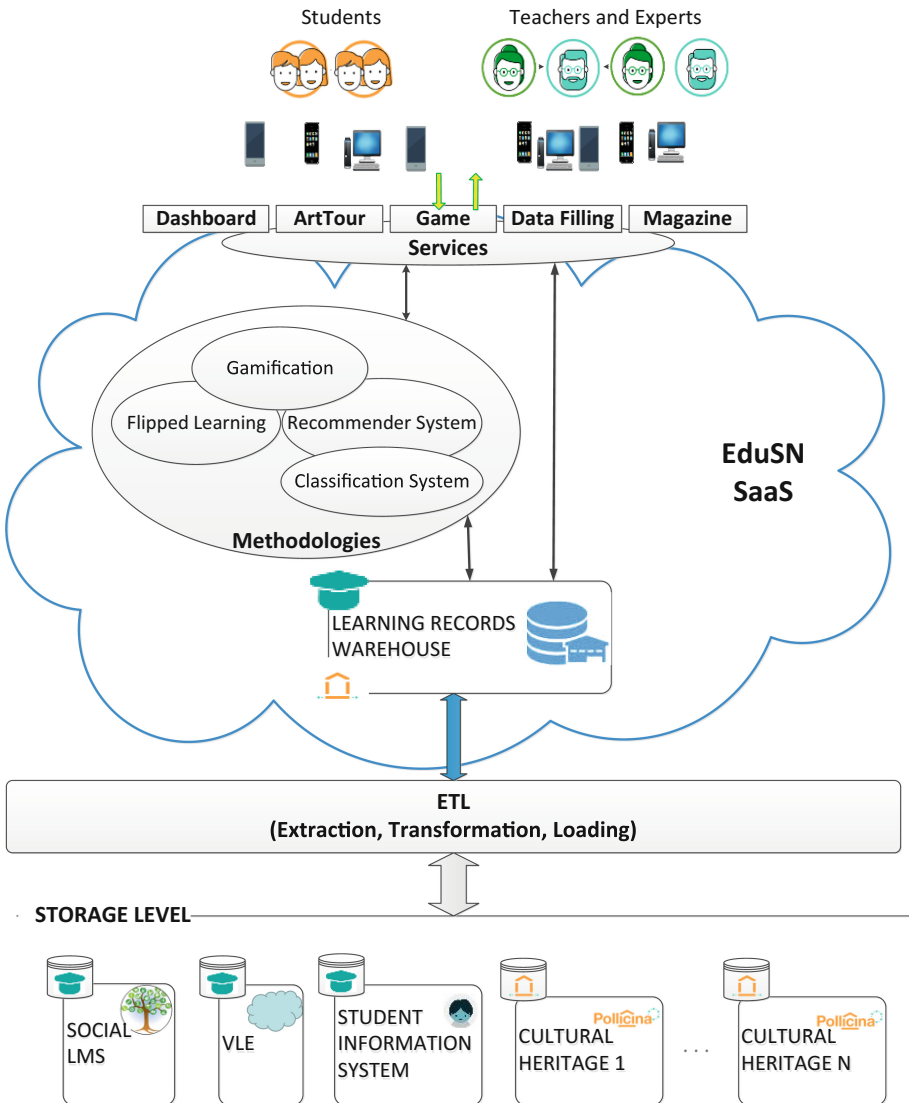


Fig. 2. The Pollicina’s architecture.

A key level of EduSN is dedicated to the services that allow a smart communication between the users and the Pollicina's knowledge with the mediation of the ad-hoc methodologies previously introduced. In detail: (1) Data Filling, this service is the first one of the EduSN platform and it is propaedeutic for the definition of the personalized itineraries, and it is aimed at defining the knowledge that will be stored in the repository (see Sect. 5 for more details). (2) Dashboard, the system monitors the user's activities and elaborates the data acquired in order both to assign badges and define indicators to track the quantitative parameters such as accesses to the EduSN platform, execution time of a task, etc. (3) ArtTour, this service is dedicated to the definition of the customized itineraries thanks to the use of off-the-shelf technology. (4) Game, users are involved in pleasant learning activities to define their own cultural itineraries by using games like puzzle, quiz, word and image association, etc. (5) The Magazine service is dedicated to gathering and public the most interesting cultural itineraries.

Users (students, teachers, cultural experts) can access to the EduSN's e-learning platform thanks to the use of external devices (e.g., mobile, tablet, pc) and applications (e.g., Web Clients, Application Services, etc.).

4 The Data Representations in Pollicina

The starting phase of the project is dedicated to the gathering of the material provided by the cultural heritages (museums, churches, archaeological sites, etc.) that have joined to the Pollicina project. During this process we have tackled different problems ranging from the difficulties to manage heterogeneous material (e.g., paintings, archaeological finds, statues, etc.) to the lack of a partial or full digitalization of the material itself. To this aim we have analysed the cultural representations used in the literature in order to provide a unique schema for synthetizing the information for Pollicina. A need of this project is to guarantee a version of the material that is able to simplify the collaborative work of the students during the editorial phases of the data filling process. This goal is achieved by defining a unique meta-data schema representing the heterogeneous nature of the cultural heritage objects.

Figure 3 presents an overview of the methodology adopted to establish the data representations in Pollicina. In detail, we have identified 5 forms for Pollicina: author, cultural heritage object, cultural site, indoor space, and outdoor space, respectively. These forms are the outcome of our analysis after the study of certified guidelines used in the literature, i.e. SIRBeC (<http://www.lombardiabeniculturali.it/sirbec/>) and Europeana (<http://www.europeana.eu>), the European open source portal dedicated to the cultural heritage knowledge. SIRBeC is the information system of cultural heritage of the Lombardia Region (Italy) that follows the Italian standard of the ICCD (central institute for the catalog and documentation) institute. The more complex part of the work has been to analyse the schemas related to each type of cultural material; indeed, SIRBeC has about 24 forms (e.g., paintings, archaeological finds, statues, etc.) for the cultural heritage objects, whereas one for author and one for cultural institute site.

Our goal is to propose to the students a simplified knowledge of the cultural material, and at the same time this definition has to be exhaustive since such material is used by teachers to prepare the lessons. To this aim, first we have identified the SIRBeC form closer to our intent from the 24 ones (i.e., the “archeological” form), and then we have extracted the fields useful for Pollicina. Table 1 shows the number of fields dedicated to the definition of the three main forms, i.e. “Cultural Heritage Object Form”, “Author Form”, and “Cultural Site Form”. In general, the Pollicina’ forms have less fields than the SIRBeC ones in order to simplify the student’s tasks as previously described. In particular, the “Cultural Heritage Objects” form has 121 fields of which 97 from the SIRBeC form, the remaining 33 fields are novel and proper of the Pollicina project (see Sect. 5); the “Author” form has 24 fields of which 14 are novel and proper of the Pollicina project (e.g., the place of death, biography website from Wikipedia, image, etc.); and the “Cultural Site” form has 32 fields of which 24 are novel and proper of the Pollicina project (e.g., weblink, ticket cost, contacts for visit, description of the indoor/outdoor location, etc.).

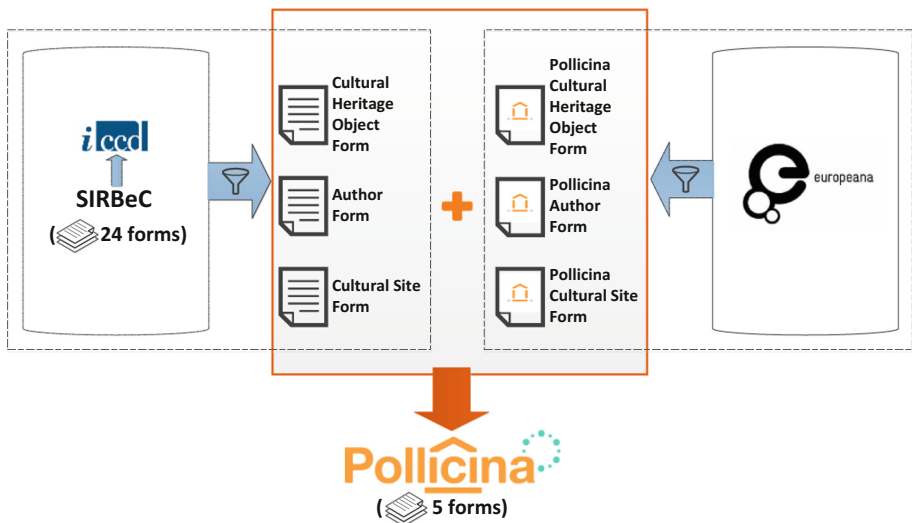


Fig. 3. The schema adopted for representing the Pollicina’s meta-datas.

In addition, we have analysed the Europeana’s meta-data to consider novel attributes with respect to the SIRBeC and the Pollicina fields’. In detail, from the “Cultural Heritage Object” form, the attribute “concept” for describing the content of the material, “Author” form, the attribute “biography”, and “Cultural Site” form, the attributes “GPS coordinates of the cultural site”, and “the description of the indoor/outdoor location”.

Table 1. Attributes used to define the material of the cultural institutions

	Cultural heritage object fields	Author fields	Cultural site fields
SIRBeC	278	64	43
Pollicina	121	24	32

5 The User Experience with the “Data Filling” Service

This section presents the “Data Filling” service aimed at bringing the students closer to the cultural heritage materials where the learning activity is proposed in a pleasant way with respect to standard methodologies of study such as books, Web knowledge, lessons in class with the teacher, etc. The “Data Filling” is the first service of EduSN and it is propaedeutic for the definition of the **personalized itineraries**. This service is aimed at defining the knowledge that will be stored in the repository as shown in Fig. 2. By using this service, the students can access to the assigned cultural form dedicated to a specific cultural material, and then fill the content. The proposed editorial process is supported by a novel workflow for managing the steps of the editorial process with a focus on the collaborative aspects, see Fig. 4 for the details of the workflow.

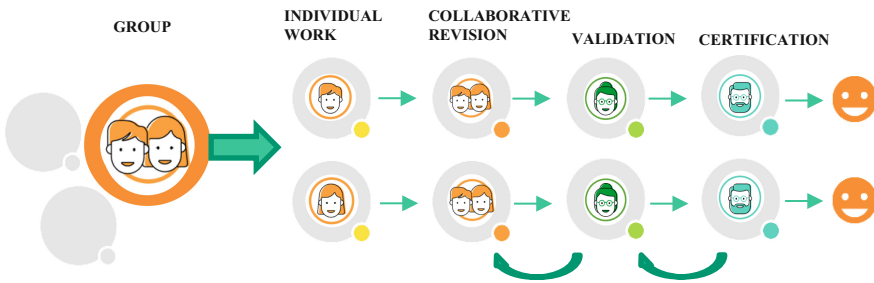


Fig. 4. The editorial workflow to certify the cultural material.

The staff of Pollicina is digitalizing all the material shared by the cultural heritage institutions that joined at the project. Then, thanks to the support of our cultural expert the content is opportunely modified and enriched. Once this phase is concluded, the secondary school students, during the activities of the “alternanza scuola lavoro”, are expected to study in depth the material and enrich the content. This learning phase establishes a first coordinated and collaborative process where the students are divided into groups to enrich the information of the cultural heritage objects. A student (1) learns to search for information by several sources of knowledge, (2) summarizes the texts, (3) shares comments to improve the content of the attributes. The interactions among peers are supervised by the teacher and the new knowledge produced is assessed by experts of each cultural institution. Indeed, an expert can approve the

completed schema, thus certifying the quality of the work, or can refuse it adding explanations. The certified material will be accessible to students in order to create the cultural itineraries and then obtain a flipped learning experience.

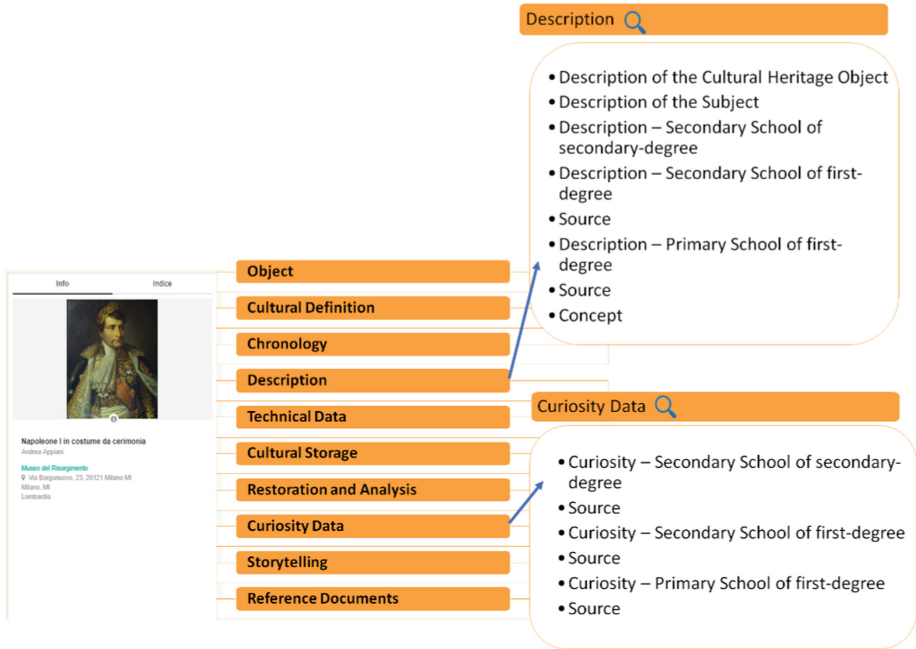


Fig. 5. An extracted of the fields used for the “Cultural Heritage Object” form in Pollicina.

Thanks to the support of our expert in Art and Teaching we have modified and elaborated the descriptions of the cultural heritage material from the SIRBeC forms. Indeed, the cultural knowledge must be accessible to all ages of the students involved allowing them to have textual descriptions according to their level of education. According to the scholastic institutions, we have filled in several attributes in order to help and support the students during the completion of the other attributes. At the end, for each school, we have assigned the schemas precompiled. Figure 5 presents the main fields of the “Cultural Heritage Object” form with a focus on the “Description” and “Curiosity Data” fields, that are some of the novel attributes added for the Pollicina’s schema. During this phase, a student learns how to look for information from several sources of knowledge, for example, by using search engine in order to complete the “Curiosity” and “Description” attributes for the specified level of education, he/she summarizes the textual information by the reference website and by the given text within the assigned forms. In addition, he/she can edit the website used to take information and add the curiosity information logically linked to the material of the form that will be accessible during the augmented visit of users within the cultural

institute. The site visits will also include scenarios for users who are visually impaired; the paths and applications will be equipped with the technologies enabling vocal tools supporting audio-guide.

6 Conclusions

The “Pollicina” project is aimed at defining a collaborative social suite called EduSN that follows the principles of the Education 3.0 paradigm. The goal is to obtain an active participation in the cultural life: users will approach the historical and cultural issues through a direct involvement in amazing activities sharing comments, experiences, ideas, social feedbacks. A first phase conducted by the staff of Pollicina has been to define ad-hoc data model representing the cultural knowledge taken inspiration by certified meta-data schemas used in the literature. Furthermore, this paper presented the “Data Filling” service that is dedicated to the digitalization of the cultural heritage material provided by the cultural heritage institutions that joined to the project. Students work on editorial committees, having both the role of editor and reviewer. They become the producers of knowledge, with peer help, under the guidance of teachers and experts of cultural institutions.

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