



DESCRIBING THE EDUCATIONAL ROLE OF NATURAL HISTORY MUSEUMS: AN ANALYSIS TOOL FOR PRE-SERVICE AND IN-SERVICE TEACHERS

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Abstract:

This study presents a tool for description and potential analysis of the educational role of the Science and Technology museum. This tool has been constructed from the point of view of formal education and it is proposed as a framework for the approach of the science/technology museum from the teachers and education administrators. More specifically, the tool is, at first, described in terms of structure, content and functionality and, afterwards, examples are provided for cases of international, national and local natural history museums (Natural History Museum in Paris, Goulandris Natural History Museum in Athens and University of Patras Zoology Museum accordingly). Finally, there is a discussion regarding the suitability of this tool to inform, instruct and train future and in-service teachers in aspects of museum education.

Keywords: Science and Technology museum, Natural History museum, educational role of museum, pre-service and in-service teacher education

1. The educational role of Science and Technology museum

During the last decades, there is a trend for science and technology (S&T) museums to, on the one hand, restructure their material in order to make it more efficient from a communicative point of view and, on the other hand, create privileged relationships with formal education institutions (schools and universities) so as to (re)design their educational policy (Publics et Musées, 1995; Schiele & Koster, 1998; Diamond, 2000; Friedman, 2010; Filippopoliti, 2010; Dillon, 2015). In Greece, the need for communicational and educational renewal of S&T museums is even more essential, since the existing ones continue to be mostly collections museums, while on the same time their

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educational role remains largely restricted to traditional type of visits (Kirchberg & Trondle, 2010; Patrick & Tunnicliffe, 2013)

The initiative for the upgrade of the educational role of S&T museums should be certainly taken on the museums' behalf. However, it is possible for the formal education domain to contribute towards this direction by reinforcing, first of all, the connections between school/university and museum. Such connections are feasible to be created in terms of educational policy for educators' instruction and training. Regarding the latter, it appears that for the development of such connections between formal education and education at the museum in a regular basis, the most appropriate settings are the academic educational structures that train educators for all educational levels (Kelly & Fitzgerald, 2011).

In Greece there are several departments of Educational Sciences that develop remarkable research and put substantial educational effort into training future teachers in order for the latter to be involved with museum-pedagogical actions in a structured manner during their service time. As for instance, during the past decade the Department of Educational Sciences and Early Childhood Education (DESECE) of University of Patras, in cooperation with S & T museums, fosters the research and the training necessary for the development of methodology addressing the design of educational programs appropriate for pre-school and primary school children (Filippopoliti & Koliopoulos, 2012). For pre-service and in-service teachers to design and implement relevant educational programs, they should hold adequate knowledge of the nature and features of museums' *educational role*.

Consequently, this study addresses the goals of formal education, but at the same time it also intends to empower the development of essential relationships between the school/university and museum, irrespectively of domain this initiative starts from. The educational relationship between S&T museum and formal education is complicated and vague (Allard, Boucher & Forest, 1994; Caro 1997; McLaughlin, Smith & Tunnicliffe, 1998; Fenichel & Schweingruber, 2009; Meunier, 2018). The examination of the teaching and learning dimensions that arises from this collaboration is still at a preliminary stage because of the wide variety of S&T museums and the different forms this collaboration would take, but mostly due to the lack of appropriate tools for analysis and evaluation. This study is focused on the potential and the manner in which formal education can systematically approach the educational role of the S&T museum, namely how the museum primarily deals with the education of school populations. We are also interested in the investigation of the educational role of the S&T museum *macroscopically* in principle, namely without scrutinizing those details that are relevant to the particular features and detailed content of the several educational actions. Conversely, our intention is for this study to facilitate distinguishing the various educational actions that the museum alone or in collaboration with schools or/and other social and educational institutions implements and to answer inquiries about the sources of the educational actions in regard to their designers and target groups. This study can lead to the formation of *typologies* for the educational role of various S&T museums' categories that

can be particularly useful, on the one hand, to the teachers and the administrators of formal educational systems, since they can make comparisons between museums and attribute meaning to the numerous educational actions that they propose, and, on the other hand, to the persons in charge on behalf of the museums for their educational actions that can proceed to the evaluation and possibly to the restructure of their educational role through the comparison to other museums.

In the present study we will demonstrate a tool for the macroscopic description of the educational role of a particular case of S&T museum: The Natural History museum. More specifically, we will describe the structure, the content and the functionality of the particular tool and, subsequently, we will provide examples for its application in museums in an international, national and local range. Finally, there is a discussion regarding the suitability of this tool for the information, instruction and training of future and in-service teachers in aspects of museum education (Rix & McSorley, 2010; Morentin & Guisasola, 2014; Gkouskou & Tunncliffe, 2019).

2. A tool for the description of the S&T museum educational role

Widely known efforts have been made internationally and in Greece, to highlight the key features for the essential approach between the school and the museum, either through simple collaboration in educational programs or through the formation of a more permanent and operational relationship (Ramey-Gassert, Walberg & Walberg, 1994; Buffet, 1995; Hofstein & Rosenfeld, 1996; Cohen, 2001; Eshach, 2007; Osborne & Dillon, 2007; Gupta, Adams, Kisiel & Dewitt, 2010; Reiss et al., 2016). The existence and the development of this relationship can constitute a primary context for the description of the educational role of the S&T museum. As a result of that, one can classify the various educational actions that the museums propose in relation to the degree of their association with the formal educational system. Figure 1 presents a layout of the descriptive tool we propose in this study. In this section we will analyze the structure and content of the tool, highlighting at the same time its basic features.

The proposed typology of educational activities consists of three fundamental categories of activities. The first one refers to activities that take place *within the S&T museum* and are exclusively designed by the museum's executives. The second category is related to activities that unfold in the *museum or/and the school* and they can either be designed by the administrators of each domain or be formed as a collaboration product. The third one refers to those activities that happen *entirely in the school* setting but originate from the museum's domain. Each category includes several forms of educational activities that associate, on the one hand, with the group of people that organize them, and, on the other hand, to the different target groups they address to.

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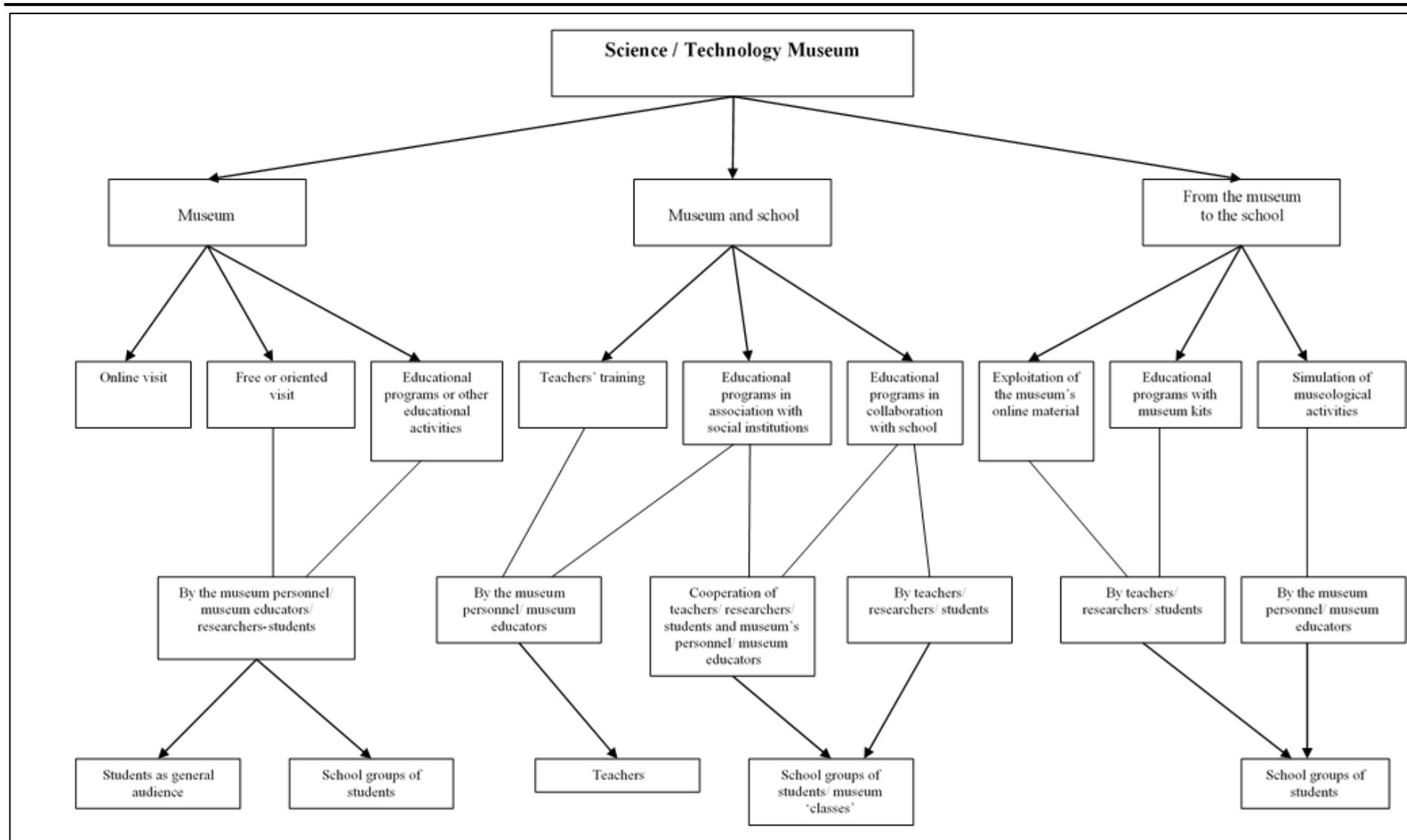


Figure 1: The tool for the description of the educational role of the Science and Technology Museum

2.1 Activities at the Museum

In this category one can find the activities ‘Online visit’, ‘Free or oriented visit’ and ‘Educational programs or other educational activities’. These refer to the most common educational activities offered by the museums to the students as an audience in general or as organized groups (Yalowitz & Bronnenkan, 2009; Reiss & Tunnicliffe, 2011). The online or *virtual visit* is a comparatively recent activity, the content of which relates directly to the quality of the relative tools provided by the museum’s website. The virtual visit may allow *static* or *dynamic* interaction between the Internet user and the venues, the displays and the exhibitions of the museum. Remarkable examples of online visits are the virtual exhibitions of ‘Museo Galileo’ in Florenceⁱ and ‘Musée des Arts et Métiers’ in Parisⁱⁱⁱ.

The main activity regarding the approach of the S&T museum from the school’s side is the actual school visit. We make a distinction between two kinds of visits, the free and the oriented, in which the museum’s intervention can take several forms. The *free visit* suggests the most traditional approach method on behalf of the museum. The students walk around the exhibits without any explicit and unequivocal restrictions from a particular educational context acknowledged by the museum or the school. Numerous museums try to render the school groups’ free visit more structured. Therefore, they offer visit guides with educational content or even ‘visit pathways’, through which the students can discover specific exhibits with the assistance of questionnaires or other types of material. The *oriented visit* improves, in the museums’ belief, the effectiveness of the museum’s communication and makes their connection with the school more functional and profound. We distinguish several types of oriented visit (Cohen, 2001); these are based on (a) the *guided tour* and its forms (explanation of the exhibits, lectures, demonstrations), which is influenced by the personality, the expertise and the skills of the museum staff, (b) the *enriched guided tour* that makes use of audiovisual means as well as the attendance to lectures and demonstrations and (c) the attendance to activities that favor the students’ participation in interactive and other kinds of cultural activities (animation). Participation in games or workshops can be a promising field for such activities to unfold.

Structured forms of enriched guided tours are the *educational programs* offered by the museums (Price & Hein, 1991). These programs take various forms, and they aim to promote the material the museum produces and the meaning the museum attributes to its resources. In more theoretical terms, we can claim that they contribute to the production of ‘interpretation’ for the museum collections and the notions they underpin. In those cases, the interpretation stands for the ‘explanation’ or the ‘translation’ of collections and notions for which the museum’s authorities either intend to impose a

¹ <http://catalogue.museogalileo.it/>, accessed 19 December 2020.

² https://artsandculture.google.com/streetview/mus%C3%A9-des-arts-et-m%C3%A9tiers/SwG0_g_7KMSEqw?sv_lng=2.355556883990772&sv_lat=48.86667135267068&sv_h=339.94419043783597&sv_p=-1.4459745852566783&sv_pid=EmJRvH-2YRrRfvOJ9Koi_Q&sv_z=0.2662306702254664, accessed 19 December 2020.

specific ‘reading’ for them or put efforts for the visitor to attribute their personalized meaning to them (Jacobi & Meunier, 1999; Black, 2009). The unit that organizes all of the above is the museum exclusively; its specialized staff (museum educators, mediators etc.) or freelancers (usually specialists in a scientific or technological field) take on the implementation of the various programs within the museum.

2.2 Activities at the Museum and the School

The activities ‘Teachers’ training’, ‘Educational programs in association with social institutions’ and ‘Educational programs in collaboration with the school’ fall under this category. These activities usually derive from the museum and especially from the kind of museum that is friendly to formal education institutions and pursues cooperation with them (Allard & Boucher 1998; Morentin & Guisasola, 2014) or/and from formal education institutions when they promote innovational conceptions regarding the content and the teaching method of school curricula (Anderson, Piscitelli & Everett, 2008; Falk, Heimlich & Bronnenkant, 2008; Falomo-Bernarduzzi, Albanesi & Bevilacqua, 2012). A key action that some S&T museums take is the establishment of *teachers’ training* groups. As for instance, the ‘Exploratorium’ in San Francisco offers an organized and systematic educational work, as it possesses a center and gives the teachers the opportunity to get in touch with scientifically trained staff in order to supplement and update their knowledge or/and use the museum’s pedagogical resources^{iv}.

However, the basic activity within this category are the educational programs that are designed and implemented in association with numerous cultural institutions (communities, unions) or with formal education institutions (school, university) and, mostly, in cooperation with educators. The difference between these educational programs and those that originate exclusively from the museum is that their educational goals suggest a product of cooperation among institutions with diverse aims and types of action; as a result, the content of these programs obtains a unique autonomy in comparison to the explicitly pronounced popularized and explanatory content of the museum’s collections and exhibitions.

A characteristic case of a program deriving from the coequal cooperation between museum and educators is the *Villette class* at the ‘Cité des Sciences et de l’Industrie’ science center in Paris, where a school children’s group is accommodated for a week at the museum’s establishment in order to accomplish a plan, which has been devised from the school teacher’s that participate in the program, corresponding to the context of the educational resources and activities provided by the specific science center (Ferran, 1997). Other types of educational programs, that are designed on the base of a *coequal collaboration* between museum and formal education, include three educational phases. These phases are developed in different times and locations: the phase before the visit takes place in school, the phase during the visit takes places in the museum venues and

³ <https://www.exploratorium.edu/education/professional-development-programs>, accessed 19 December 2020.

the final phase takes place in school, just like the first one. The formation of the content of the three phases is a process that usually occurs in a totally empirical manner or follows the principles and rules that are imposed by the academic research in science education (Allard, Boucher & forest, 1994; Filippoupoliti & Koliopoulos, 2012; Meunier, 2018). Most of these programs are commonly implemented by educators that may have gone through relevant training and usually have been working collaboratively with museum specialized staff.

2.3 Museum activities in school

The included activities in this category are 'Exploitation of the museum's online material', 'Educational programs with museum support/devices' and 'Simulation of museum activities'. If the school does not visit the museum, then the opposite can happen. Schools of remote districts or schools that have no access to the S&T museums' collections or exhibitions have an opportunity to approach them through the use of virtual or actual material they offer. Specialized staff's visits to schools also transfer content, experiences and material from the museum venue to school. The museum devices, often characterized as *educational kits*, suggest the material foundation layer of educational programs that are designed and offered by the museums to the schools in a form of suitable material (micro-slides, teleplays, maquettes, samples or scientific devices). The integration of such materials in traditional teaching units or other forms of teaching structure is possible to enrich the curriculum with concepts, methods and cultural content of science and technology by ensuring at the same time the increase of interesting and positive attitudes towards them. The approach of the various forms of museum's *simulation activities*^v consist some cases of museological activities centered in the school venue (Rix & McSorley, 2010; DeWitt & Storkdiesk, 2008). Another efficient form for the integration of museum resources into school curriculum are the *visits from museum staff to school classes*, intending to the *reinforcement* of educational work, suggests (Paquin & Allard, 1998).

3. Application of the descriptive tool

3.1 Sample of museums under investigation and description technics

Three cases of implementing the proposed tool follow herein, with the aspiration to emphasize those elements that we consider important for reassuring its capability to represent in a coherent, consistent and valid way the educational role of various S&T museums. In order to methodologically ascertain the above, we believe that the sample of museums that we would choose for the implementation of our tool should consist of museums of the same category, in order to make sure that the homogeneity would lead to legitimate *comparisons*, but also with different qualitative features as so as to try out its *discriminant ability*, namely its ability to point out these characteristics. Therefore, we

⁴ <https://www.exploratorium.edu/education/teaching-resources>, accessed 19 December 2020.

chose Natural History museums, a typical traditional S&T museums' category, of international, national and local range (Mujtaba, Lawrence, Oliver & Reiss, 2018). In the current study we will present the case studies of the 'Muséum National d' Histoire Naturelle' in Paris (international range), the 'Goulandris Natural History Museum' in Athens (national range) and the 'University Zoology Museum' in Patras (local range), although the tool has been implemented at a larger museums' sample. However, no safe conclusions can be drawn regarding the tool's validity until it is implemented at a typically random museums' sample, in other S&T museums' category and from a larger group of researchers.

Data collection can be accomplished through observation on the spot, interviews with the museum staff, the study of the museum's website or all of the above. The data presented here was collected through the analysis of museums' websites. Information from such sources were imported in an Excel worksheet and have been categorized according to the following criteria: (a) types of educational activities offered by each museum, (b) people involved in such activities and (c) audiences they address. Our data will be supplemented with museum staff's interviews; the protocol for these interviews is currently under design.

3.2 Muséum National d'Histoire Naturelle (Zoology wing)

In Figure 2 we present the profile of the most iconic venue of 'Muséum National d'Histoire Naturelle', the 'Grande Galerie de l'Évolution' ('Gallery of Evolution')^{vi}. It seems that the museum is active in two out of the three categories of educational activities. It provides only *static* forms of online visits for some of its collections. It also certainly provides and promotes the two basic categories of actual visits. Regarding the free visit, the educator has access to educational material for some thematic units. The oriented visit can take various forms, such as guided tours (i.e., 'Journey to the heart of biodiversity', 'Evolution of life') and workshops for young children and students (i.e. 'How to classify the living organisms'). However, at the same time the museum invites the educators to organize their own educational programs in association with the museum specialized staff; for example, in case they are interested in delving deeper into a subject matter. This invitation can take four different forms: (a) collaboration between the museum and the networks of educational priority, in which case school classes that belong to underprivileged districts design a sequence of visits during the school year, (b) the design of 'museum classes', in which case the educators submit an educational program that is actualized in school as well as in the museum, (c) the involvement of the museum in the senior year high school students' research project that is a subject of their graduation examinations and (d) the design of 'cross-curricular thematic museum classes', in the duration of which visits are carried out at museums of various kinds in order to study the scientific, historical and esthetic principles of a specific thematic unit.

⁵ <https://www.jardindesplantesdeparis.fr/fr/programme/galeries-jardins-zoo-bibliotheques/grande-galerie-levolution-2763>, accessed 19 December 2020.

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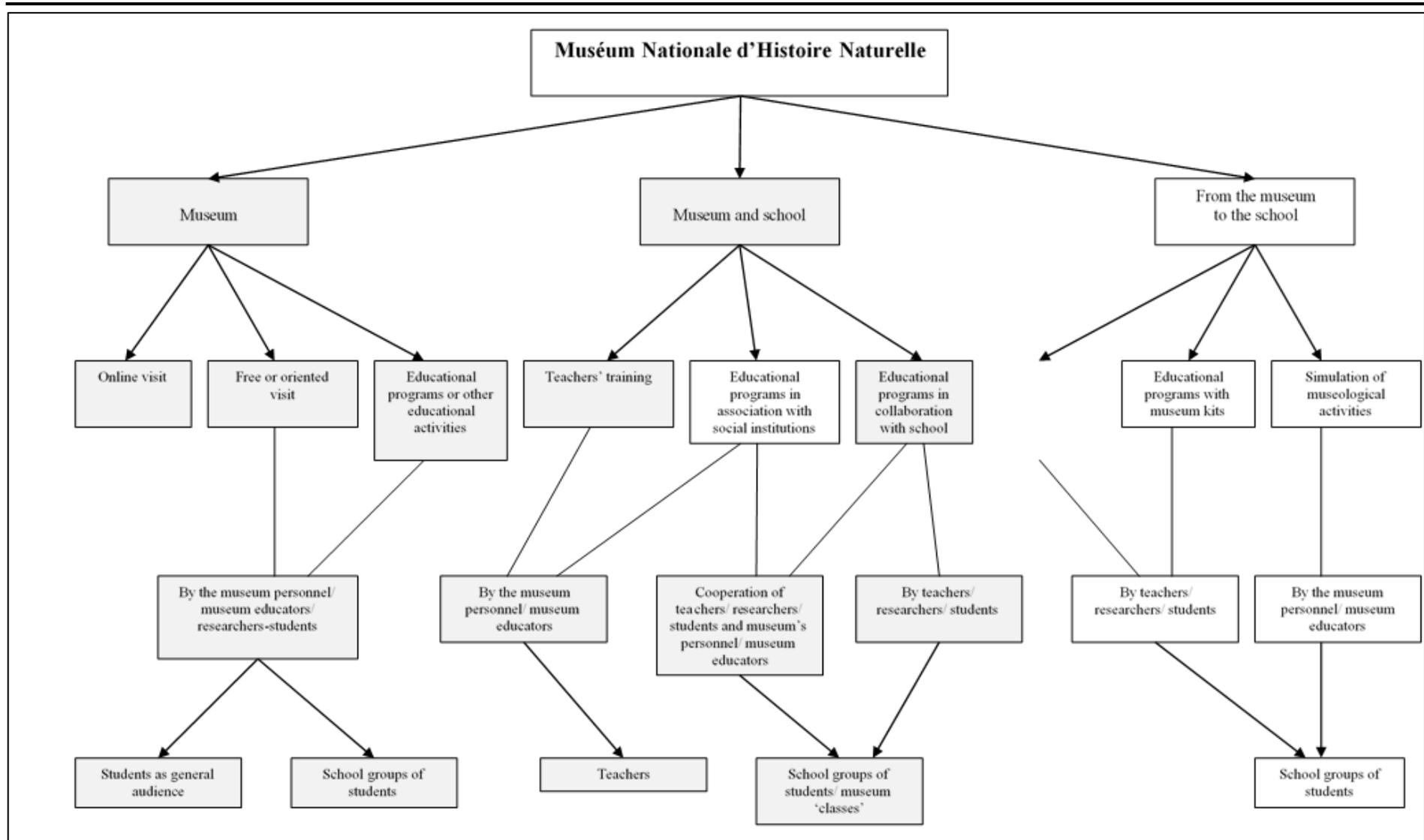


Figure 2: Implementation of the tool for the description of the educational role of the Muséum Nationale d'Histoire Naturelle

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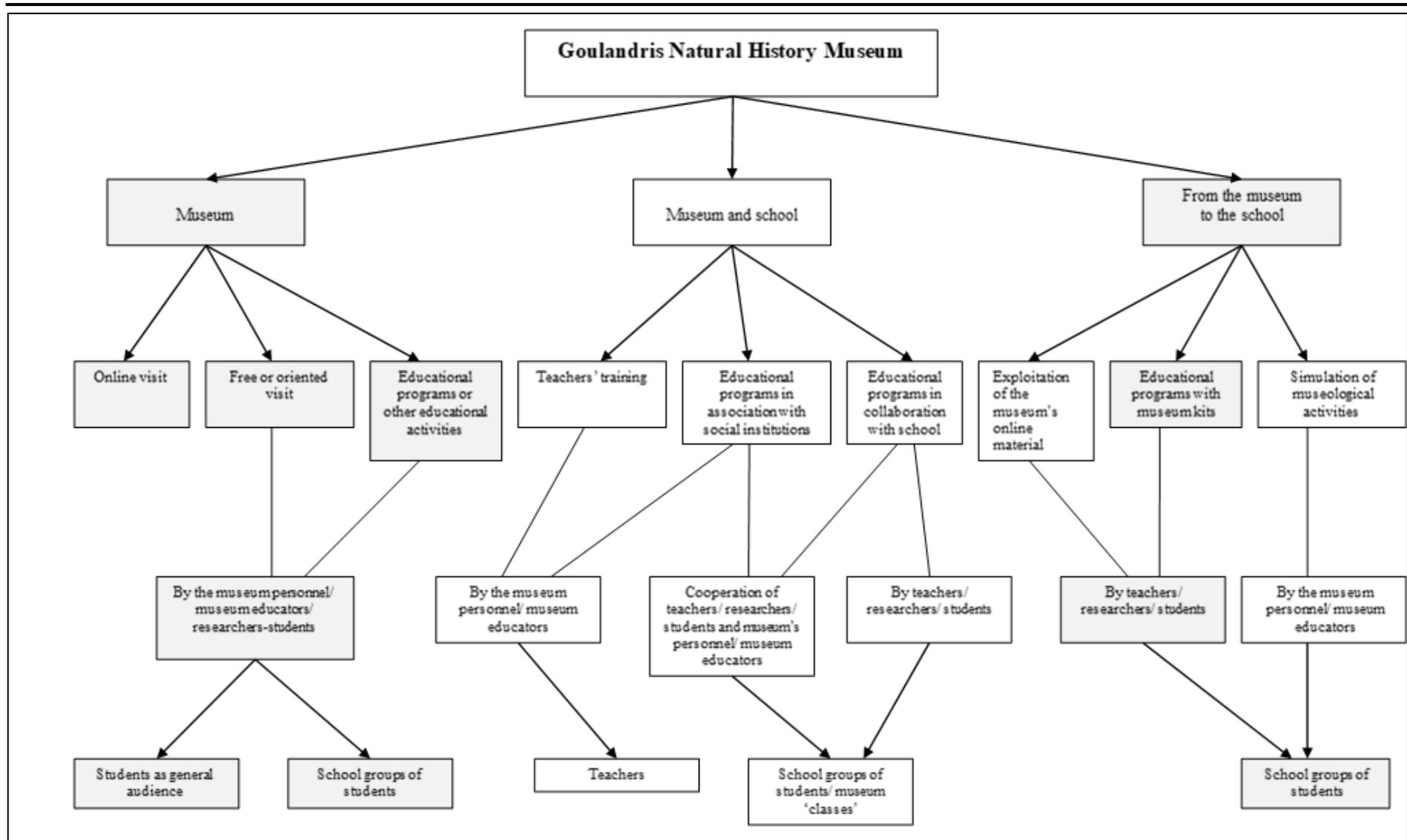


Figure 3: Implementation of the tool for the description of the educational role of the Goulandris Natural History Museum

In all of the above cases, educational programs take a form of institutional facility provided by the museum in full cooperation with school. Additionally, the museum offers training programs for future and potential teachers^{vii}. Finally, the provided online educational material is most commonly associated with the museum exhibitions and therefore the educator might use it in their classrooms consequently to the museum visit^{viii}. However, the museum does not seem to offer a suitable area for the simulation of museum activities neither museum devices for in-school use.

3.3 Goulandris Natural History Museum (Zoology wing)

As Figure 3 illustrates, the zoology wing of 'Goulandris Natural History museum'^{ix} displays a different profile in comparison to 'Muséum National d'Histoire Naturelle' in Paris that was above analyzed. Regarding the first category, there are no alterations. The museum provides static and dynamic online visits^x, while it recommends both free and oriented visits to its exhibitions and scientific workshops. The oriented forms of visit are guided tours and educational programs that address to school populations. The educational program labelled 'Botanologists – entomologists' is a typical example of guided tours. In contrast to the international museum in Paris, the collaboration between Goulandris Natural History Museum and school does not take an institutional form that would allow schools to have an essential role in the design and development of activities. On the other hand, the museum offers educational material such as educational folders and museum devices (i.e., 'Volcanoes of Greece' and 'Immigration of organisms' that have been designed by 'Friends of the Museum' association) for within the in-school use^{xi}.

3.4 Zoology Museum at University of Patras

The 'Zoology Museum at University of Patras'^{xii} is a typical example of a first-generation museum that refuses to update, as many of the Greek university museums, in terms of upgrading their communicational and educational functions. The museum's profile is presented in Figure 4. Setting aside the fact that the museum addresses Biology students' educational needs, its outreach is limited in the oriented visit of school classes, namely in the traditional guided tour for students. During the last few years there has been a close collaboration between the museum and Educational Departments of University of Patras in order to develop appropriate educational programs for preschool and primary education levels, while these programs have been already implemented by a large number of preschool teachers in the West Greece region (Koliopoulos, Gkouskou

⁶http://www.mnhn.fr/museum/foffice/ecole/ecole/nosConseils/rub_maternelle/som_maternelle/fiche.xsp?ARTICLE_ARTICLE_ID=691&idx=4&nav=liste, accessed 19 December 2020.

⁷<https://edu.mnhn.fr/>, accessed 19 December 2020.

⁸<https://www.gnhm.gr/en/>, accessed 19 December 2020.

⁹<https://virtualtour.gnhm.gr/en/>, accessed 19 December 2020.

¹⁰<https://filoi-gnhm.gr/site/ta-ifestia-tis-elladas-2/>, accessed 19 December 2020.

¹¹<http://zmup.upatras.gr/en>, accessed 19 December 2020.

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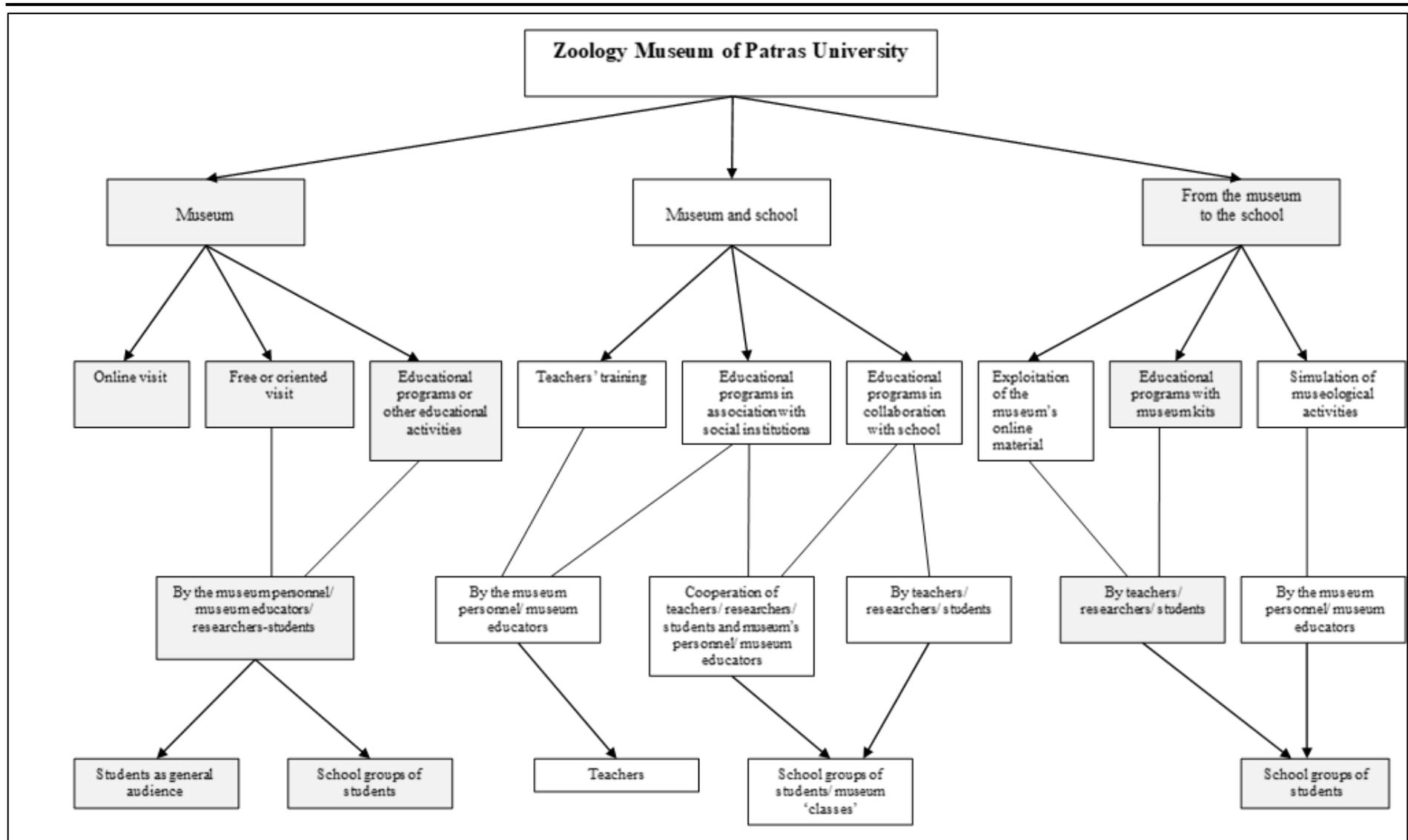


Figure 4: Implementation of the tool for the description of the educational role of the Zoology Museum of Patras University

& Arapaki, 2012). Recently, the museum has developed an activity called ‘Ornithopolis’^{xiii} which aims at bringing the citizens of Patras and scientists of the University of Patras together. Through brief seminars and ‘bird walks’ in the urban area of Patras, citizens learn to recognize the birds of the city and record their presence in a scientific way (Georgopoulou, Faulwetter, Tzortzakaki & Giokas, 2019).

4. Use of the descriptive tool

The suggested tool for the macroscopic description of the educational role of the S&T museum can be used for the description and comparison of educational activities on behalf of formal education by educators and administrators, as well as on behalf of the museum by the designers of educational activities. In addition, it is possible to be utilized in the context of museological education which is offered to pre-service and in-service teacher education and it can also have an impact to the development of academic museological research.

As a cause, but also as a product, the basic feature of the proposed tool is to enlighten formal education and teachers in particular, regarding the forms of educational activities in S&T museums and, at the same time, to facilitate the distinction between the diverse nature of such activities by attributing meaning to them. The purpose of this tool is not to evaluate the quality of the educational material that the museum provides. In addition to the above characteristics, our assumption is that the tool’s power to draw distinctions will encourage teachers to more effectively design their approach to the museum of their choice. This can be accomplished if, as for instance, they understood the diversities in the design and implementation of the *different types of educational programs* that are included in all three categories of educational activities. Still, further research on this assumption is necessary in order to confirm or disprove it.

The second intriguing utility of the suggested tool derives from its educational character at an academic level. Namely, this tool can be used for the museological education and especially for connecting the museological knowledge with the training of future teachers. For example, at the DECESE of University of Patras the students use this tool during the classes of ‘Museology of Natural Sciences’ (undergraduate level) and ‘Museology and Education’ (postgraduate level) and learn how to distinguish the various types of educational activities the S&T museums promote, as well as to describe and compare the educational role of international and Greek museums through their websites (Koliopoulos, 2017). Simultaneously, this tool can be transformed to a technique for further investigation of the S&T museum’s educational role towards the constitution of a systematic classification of educational activities and, in particular, educational programs originated from the museums; in our opinion, this consists vital issue for museological research. Our future endeavors are focused on this direction.

¹² <http://zmup.upatras.gr/en/content/what-ornithopolis>, accessed 19 December 2020.

5. Epilogue

There were clear limitations to this study. Firstly, and most notably, it was a small-scale and qualitative study, therefore attempting any generalizations would be risky. Secondly, the sample introduced in this study represents merely one category of S&T museums. For confirming the reliability of the tool in terms of coherence and uniformity, it is required to test it with larger samples in several occasions. At the same time, it is necessary to further explore the sample of S&T museums for verifying the validity of the tool (discriminative value for a wide range of S&T museums). Finally, its macroscopic nature illustrates a need for further work with this tool in order to also comprise detailed qualitative information for the assessment of the educational role of the S&T museum.

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