

THE EXHIBITION IS JUST THE BEGINNING.  
QUALITATIVE ANALYSIS OF CREATIVE  
EDUCATIONAL MATERIALS PREPARED  
BY PRE-SERVICE TEACHERS

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ABSTRACT

**Aim.** The aim of this work is to present a qualitative analysis of the creative educational materials prepared by pre-service teachers in the context of an educational experience around a museum exhibition about science and literature, described in a previous work (Martín-Ezpeleta & Echegoyen-Sanz, 2020). The responses to a final questionnaire regarding interdisciplinarity, integration of sciences and arts or the use of museums for children's education are also analysed.

**Methods.** The participants were 121 alumni of two different subjects, "Natural Sciences for teachers" and "Literary training for teachers" at a Spanish university. Pre-service teachers had to select an item of the museum exhibition and, as a group, prepare a catalogue intended for children, where they had to write a short text related to the object and activities for children in an exercise of didactic transposition. The students generated teaching materials with a high component of creativity and a multimodal approach, with a mixture of linguistic and non-linguistic codes. The qualitative analysis of these creative teaching materials was carried out with Atlas.ti v8. To assess the experience, a questionnaire about different aspects of the proposal was completed by the students at the end of the semester.

**Results and conclusion.** The analysis of the teaching materials demonstrates differences between the alumni attending both subjects in the type of items selected, the literary genre of the short text and the prepared activities. The responses to the final



questionnaire give an insight into the reasons for the selection of an item and show how most of the students considered the experience as very interesting and formative. We can conclude that the educational experience described here served as an exercise to internalise the benefits of this method and, at the same time, adapt it for their future students in primary education.

**Key words:** educational materials, pre-service teachers, interdisciplinarity, museum exhibitions, creativity

## INTRODUCTION

### Exhibits and education

Museums have always (but particularly since the 1960s) been looking for different ways to communicate with visitors and nowadays they are not just places where objects of artistic, historical or scientific-technical value are stored and exhibited. Through museum pedagogy and museum education, modern museums have developed different strategies to work with different age groups of visitors (Tišliar, 2017), and they have achieved strengthening of the experience of museum exhibits and exhibitions with informal learning. In the 21st century, museums are social spaces for learning and knowledge, although they are sometimes forced to redesign their pedagogies and modify their educational purposes, as well as account for their performance due to a cultural policy based on economic rationalism (Hooper-Greenhill, 2007).

In this scenario, museum educators do not only classify, manage and present the collections, but they are also involved in thorough educational work. The International Council of Museums, created in 1946, agreed that museums had to have a certain space inside the Museum that could be called Education Department and Cultural Action and should develop specific functions related to education and cultural diffusion. As Arja van Veldhuizen, Liesbeth Tonckens and Gundy van Dijk (2017) compiled, there are a variety of methods that can be used depending on the type of visitor, user experience, target group, investment of time and even budgetary resources. These include the usual guided tours, but also dialogues with the visitors, scavenger or treasure hunts (with and without questions), learning by doing, creative processing, object analysis, associative activities, etc.

Most of the big museums have specific programs for children. For example, in Paris both the Louvre and the Musée d'Orsay feature treasure hunts for children and families, providing an opportunity for kids to make their first foray into art appreciation. They also take advantage of new technologies: in the Louvre an educational section with digital equipment (*La Petite Galerie*) gives families an interactive introduction to the arts, whereas a tablet app The Musée d'Orsay for Families offers themed tours of the museum. The Museum of London presents a series of word games to play during the visit, activity sheets to print beforehand and fill during the visit, or activity bags for free. It also has many specific programs for families; for example, currently, at the Museum of London Docklands, there is the exhibition *Havering Hoard: A Bronze*

*Age Mystery* that helps them to discover what life was like during the Bronze Age. In Madrid the Prado Museum has an audio-guide adapted for children and a special children's itinerary; the Thyssen-Bornemisza National Museum has launched EducaThyssen, offering different routes adapted to the age of the visitor; the National Archaeological Museum has a program called *Storytelling with history*, in which a visit starts with a tale; and the National Anthropology Museum offers a special program for children with treasure hunts and interactive activities.

There are even specific children's museums with exhibits and programmes to stimulate informal learning experiences for this type of audience. These feature interactive exhibits are designed to be manipulated by children, because it is well known that activity can be as educational as instruction, especially in early childhood (Stevenson, 1991). However, smaller institutions or itinerary exhibits sometimes do not have any specific programs for children although what they offer could be very interesting and educational, as was the case of the exhibit *Frankenstein or the Modern Prometheus. Dialogues between Science and Literature*, which is explained in detail in the next section. The educational experience presented here seeks, leading by example with teachers in training, to demonstrate once again that teachers have to be very attentive to any type of cultural act that takes place in their environment, but especially to verify that these acts also offer learning that, regardless of their cultured character, can be used to educate children.

It is necessary, however, for there to be a mediation process where teachers play a key role in the absence of a museum or exhibit educator. Alan S. Marcus (2015) stresses the importance of a collaborative effort between museum staff and teachers in the case of history museums. With the specific case of this experience based on the creation of a children's catalogue of the exhibition, in addition to the didactic activities designed by pre-service teachers (shown in the results section), the main resource that we are teaching our students is that they can replicate or adapt a didactic sequence such as the one described here to be aimed at a child audience, with pedagogical benefits such as out-of-school activities, the integration of knowledge, the enhancement of creativity or, finally, writing development.

### **A Frankenstein exhibition and its double scientific and literary interpretations**

During the academic year 2017-2018, coinciding with the two hundred years of its publication, the López Piñero Interuniversity Institute for Science Studies (University of Valencia) prepared an exhibition entitled *Frankenstein or the Modern Prometheus. Dialogues between Science and Literature* (displayed from November 22<sup>nd</sup> 2017 to February 23<sup>rd</sup> 2018) at the Cerveró Palace. As detailed in its web page<sup>1</sup>, the objectives of the exhibition, open to the entire public, were

1 <https://www.uv.es/uvweb/instituto-universitario-historia-medicina-ciencia-lopez-pinero/es/instituto-interuniversitario-lopez-pinero/frankestein-moderno-prometeo-dialogos-ciencia-literatura-1285893059754/Activitat.html?id=1286019950661> (accessed June 20th 2020)

to show how throughout the nineteenth century and within the framework of the artistic and cultural movement that consolidated in Europe, a whole series of discourses that sought to harmonise understanding and imagination were articulated, while challenging the norms of objectification, even in specialised literature and among the scientific community. The exhibition addressed various aspects related to science and literature in European Romanticism, paying special attention to the scientific debates that influenced the elaboration of the novel by Mary W. Shelley: from the importance of scientific expeditions and the anatomical question to the consideration of electricity as a vital fluid, as well as the impact and consequences of this work, for example, addressing issues related to the construction of identity, the responsibility of the scientist and the development of areas such as physiology and electromedicine.

As is well known, *Frankenstein* by Mary Shelley, first published in 1818 anonymously (Shelley & Butler, 1994), is considered by many to be the first science fiction novel and has even been named 'The Origin of the Species' of science fiction (Aldiss, 1986). This literary genre offers the possibility of imagining and designing worlds and is concerned with the impact of science, either real or imagined, upon human beings or society, with an anthropocentric vision.

According to a previous contextualisation (Martín-Ezpeleta & Echegoyen-Sanz, 2020), there are many works analysing *Frankenstein* and its implications for mankind, science and science fiction, e.g. *Frankenstein: Annotated for Scientists, Engineers, and Creators of All Kinds* (Shelley, 2017), where the original version is complemented with annotations and essays of scholars who explore the social and ethical aspects of scientific creativity, or the monograph *Frankenstein. Un mito literario en diálogo con la filosofía, las ciencias y las artes* by Gonzalo M. Pavés and Tomás Martín (2018) that tackles the conceptualisation of the myth depending on the academic discipline. In *Frankenstein pedagogue* (Meirieu, 1996), the author questions the representation of education as a project with the objective of the total control of the other and one's own destiny. Other studies focus on Shelley, e.g. in *The Cambridge Companion to Mary Shelley* (Schor, 2006), leading scholars discuss her work in different contexts: literary history, aesthetic and literary culture, and the life and afterlife of Frankenstein. There are even feminist views of Shelley's work, as in "Possessing Nature: The Female in Frankenstein" (Mellor, 1988).

The fact is that *Frankenstein* has been part of the universal literary canon, with the support of even Harold Bloom (1994). It has also been part of the school literary canon, although incorrectly catalogued as young adults literature, with many adaptations even to other formats and sometimes with a relaxed interpretation as, for example, in *Frankenstein: A BabyLit® Anatomy Primer* (Adams & Oliver, 2014). For this reason, there are many educational projects related with Shelley's work all over the world, for instance, in Canada (Winkelman, 2006), Brazil (Larrys & Morey, 2017), Spain (Varela, Miñambres, López, & Ríos, 2015) or The United States (Arici & Barab, 2013), and from fields as different as English (Gozalo, Cuadrado, & González, 2002), Biology (Baños i Díez, Aramburu, & Sentí, 2005), or, among others, literary education, as in

Valdir Reginato, Dante M. C. Gallian and Suzie Marra (2018), who explore the possibilities of Frankenstein to integrate sciences and arts, as we do in the present work.

This contextualisation summarises our previous work (Martín-Ezpeleta & Echegoyen-Sanz, 2020), to which we refer to complete the matter from a more strictly cultural point of view. Next, we present the unpublished analysis of the creative educational materials prepared by pre-service teachers in the context of an exhibition about *Frankenstein*.

## METHODOLOGY

### Context

This educational experience is related to the innovative educational project “Sciences and Arts” of the University of Valencia, in which partake 20 professors of different specialities and universities with the aim of developing and implementing a transdisciplinary education. At the group webpage ([www.uv.es/ciencylet](http://www.uv.es/ciencylet)) different projects and outcomes (scientific-literary materials for children) can be consulted.

At the University of Valencia, the Faculty of Teaching is organised into different departments focused on subject didactics (Experimental and Social Sciences, Mathematics, Language and Literature, Arts, etc.). However, the relationship between curriculum studies and didactic approaches is being discussed with even thematic issues where a comparative approach to teaching and learning through didactics using new methodological and theoretical perspectives are described (Lizogat, Amade-Escot, & Östman, 2015). The fact is that elementary teachers, who have to teach content from all disciplines, have difficulties to implement interdisciplinary teaching (Duran, Duran, & Worch, 2009). Our innovative educational project aims to provide pre-service teachers with the knowledge to achieve interdisciplinary teaching in their professional endeavour by implementing transdisciplinary and interdisciplinary projects and activities in higher education, which will serve as an example.

The educational experience presented here was implemented at the same time in two different subjects, one related to experimental sciences and the other to literature, in which the same educational purpose can be achieved from different perspectives, as we have already described in previous works (Martín-Ezpeleta & Echegoyen-Sanz, 2019). After having experienced this approach in higher education, the students will realise that interdisciplinary and transdisciplinary teaching goes beyond an organisational strategy, and they will have to rethink the curriculum, the purpose of schools and the way in which knowledge is used.

### Participants

The participants were undergraduate students in their sophomore year of Primary Education or Early Childhood Education at a large public Spanish uni-

versity. Data reported here pertain to two groups of students who were enrolled in the subjects “Natural sciences for teachers” (79 students) or “Literary training for teachers” (42 students) during the course 2017/2018. Of the 121 pre-service teachers who attended the exhibition the mean age was 20.39 (median = 20), with a standard deviation of 3.09, and 79% being female and 21% male.

### **Objectives**

The main objective of the proposal here described was to motivate future teachers to reflect on museums and exhibitions and their teaching possibilities carrying out a didactic transposition, as defined by Yves Chevallard (1988): a process of adaptation to close the gap between a body of knowledge and what a student must learn about specific content topics in relationship to that scientific knowledge. The secondary objectives were to develop the creativity of future teachers, their communicative and writing competences, an approach to the complexity and repercussion of Frankenstein as a myth and as a literary work, and make them aware of the importance of using cultural activities nearby to potentiate learning.

### **Description of the activities**

The first stage was the visit to the exhibition, which contained documents, objects and pictures about the novel and its impact. Each student had to select an item to be a thematic component in a literary text for children that they had to write. They had to take a selfie with the object not only to reaffirm the election but also to start configuring the design of the multimodal text (Serafini, 2014; Cope & Kalantzis, 2015).

The second stage was the preparation of a page of the children’s catalogue of the exhibition which was related to the selected item. As usual in art catalogues, it had to contain a colour photograph of the item on display and a short formal catalogue description, but also the selfie and a short text (a poem, a microtale, a short story, etc.) using the format (typography, colours, images, etc.) of their choice to make it appealing for children. The inclusion of some activities around the discipline to which the item belonged for children was also recommended.

The last phase was the presentation of their catalogue page to the rest of the group in an exercise of peer feedback. After the suggested modifications, the composition of the complete children’s catalogue of the exhibition was carried out by the professors and distributed to the students in a PDF by virtual classroom.

A more detailed description of the phases and the specific instructions for the students can be found in the previous work (Martín-Ezpeleta & Eche-goyen-Sanz, 2020).

### **Analysis of the children’s catalogue of the exhibition**

Qualitative analysis software Atlas.ti v8 was used to support the analysis process. 121 primary documents (each page of the catalogue) composed the hermeneutic unit of the analysis project. An iterative analysis consisting of

close reading, organising, interpretation, and summarising was followed. First, we read the catalogue thoroughly several times to obtain an overall familiarity and understanding. Then initial codes were created attending to the type of object selected by the students, the suggested activities for children and the type of literary text prepared.

## RESULTS AND DISCUSSION

### Analysis of the catalogue for children

The museum exhibition items were classified as related to medicine (surgical instruments, anatomic model of the hand, etc.), electromedicine (electrotherapy machine, portable electrocardiograph, etc.), electricity (Wimshurst machine, plasma globe, etc.), literature (anatomy books, Shelley poster, etc.) or directions (marine compass, sextant, etc.). Some examples of the items, as appear on our web page where the catalogue pages can be consulted when clicking in each item, are shown in Figure 1.



Fig. 1. Some examples of the exhibition items, as shown on our web page.  
Source: own research.

As shown in Table 1, most pre-service teachers selected items related with direction, followed by those related to electricity, medicine, the combination of the former and, in a lesser extent, the ones related to literature. However, differences between the alumni attending both subjects can be observed. The alumni from "Literary training for teachers" selected in the second position

those items that could be related to literature, while those alumni attending “Natural sciences for teachers” selected primarily items related to electromedicine and no one selected any item related to literature.

Table 1.

*Absolute and relative frequencies of items related to each field selected by pre-service teachers in both subjects: Natural sciences for teachers (ST) and Literary training for teachers (LTT).*

	Absolute frequency	Absolute frequency	Absolute frequency	Relative frequency	Relative frequency	Relative frequency
	ST	LTT	Total	ST (%)	LTT (%)	Total (%)
Direction	25	16	41	31.6	38.1	33.9
Medicine	19	7	26	24.1	16.7	21.5
Electromedicine	21	3	24	26.6	7.1	19.8
Electricity	14	7	21	12.7	16.7	17.4
Literature	0	9	9	0	21.4	7.4

Source: own research.

Likewise, we classified the activities proposed by the pre-service teachers (see table 2) according to their purpose. Some of them had the objective to gain knowledge about the item or the item field, i.e. different experiments related to physical phenomena, animal dissections, webquests, manipulate machinery, etc. Others aimed to enhance children’s creativity by making crafts, creating murals or models on the theme, writing alternative endings to the story, etc. The objective of the third group of activities was to motivate the reflection of the children about some issue connecting it with the exhibition item or the written story (e.g. gender equality, attention to diversity, differences between present and past scientists, etc.). The last group of activities were those related to outdoor education either in natural or urban environments.

Table 2.

*Absolute and relative frequencies of the type of activities proposed by pre-service teachers.*

	Absolute frequency	Absolute frequency	Absolute frequency	Relative frequency	Relative frequency	Relative frequency
	ST	LTT	Total	ST (%)	LTT (%)	Total (%)
Knowledge	51	27	78	57.3	61.3	58.6
Creativity	25	8	33	28.1	18.2	24.8
Reflection	5	7	12	5.6	15.9	9
Outdoor education	8	2	10	9	4.6	7.5

Source: own research.



It can be observed how most pre-service teachers prepared activities related to gaining knowledge about the fields of the items or the items themselves, followed by creative activities. The reflective activities such as debates or taking the children out of the classroom to nature or hospitals were proposed to a much lesser extent. In this case, there are no significant differences between pre-service teachers attending both subjects, although a slight tendency to prefer reflective activities to outdoor education is apparent for alumni from "Literary formation for teachers" and the opposite for alumni from "Natural sciences for teachers."

All proposed activities can be consulted on the web page of the innovation group, with the student's permission and creative commons license. As an example of an activity aimed to gain knowledge about literary genres, one student proposed a wheel with different literary genres (a joke, a riddle, a poem, a short story and a short play) around the figure of Frankenstein and questions, e.g. What literary work is it? Who wrote it? Who is the main character? (Marine compass, L.M., LTT). Sometimes the students proposed more than one activity based on the same item, covering different areas of knowledge and goals, as in the following example of a catalogue page for the electrotherapy machine (F.T., ST):

- In the first place, to make students familiar with electromedical equipment, they will be asked to use new technologies to search the Internet for images of this type of device.
- Then, taking the story as a reference, students will discuss the importance of values such as solidarity, camaraderie and the effect of terminal illnesses on families.
- Finally, a teacher could propose and organise an excursion to a medical centre, with prior permission, so that the students could closely observe the electromedical equipment.

The alumni had to include in the catalogue page a literary text (of any literary genre), in which the item had to be included, and try to explain its purpose to the children. Here are some examples that show the mixture of narrative genres, poetic, epistolary and even screenplays. It is worth noting that all alumni from ST wrote a short story except one that wrote a screenplay, while more variety could be observed in alumni from LTT, with 12 students writing poems and one student a letter. Two examples of short stories are presented below:

- Story about the Whimhurst machine:  
In a faraway land lived a goblin named Utingnomi the Witty King. The little goblin was very worried because all the flowers and trees of his kingdom had died due to drought and the clouds of his country did not know how to make storms. He decided to settle the matter and tried to invent something that would solve that problem. In a few days, the goblin had created a fantastic gadget, the Wimshurst machine, a high-voltage electrostatic generator that produced sparks from the accumulation of charges of different signs, causing the dielectric breakdown of the air. A flying goblin was in charge of rising the machine to the clouds and when they wanted

rain, they just rolled the crank of the machine. The disks rotated in opposite directions, producing sparks that triggered a series of reactions, thus stimulating the clouds causing storms. Now they could have rain whenever they wanted, and never again the kingdom of Utingnomi was sad and desolate for not having flowers and trees (I.R., ST).

- Story about the Universal Exciter:

That morning, Franky was in his lab doing some of his ground-breaking experiments on electricity as he used to do. His companion, the hamster Lolo, with whom he loved to have long conversations about how exciting his work was, was helping him. Suddenly, the hamster stopped talking and this seemed very strange since Lolo was not silent for a single moment, so Franky decided to turn to see what was happening. When he did, he couldn't believe what he was seeing. Lolo was on his back and seemed not to be breathing. Franky was very nervous, he didn't know what to do. Then a slightly risky idea came to his mind, but it could work. It was agreed that the Universal Exciter could move the muscles of some animals after they passed away and he thought that perhaps it could make Lolo's heart beat again. If the electric shock was too strong it could kill him, but since it was the only solution, he didn't think twice and got down to business. After a few seconds of uncertainty, Lolo breathed again and they both hugged each other tightly (J.R., ST).

#### **Students' assessment**

At the end of the semester, the students filled a short questionnaire to evaluate the impact of the activities described. First of all, they were asked if they considered it interesting to have the *Frankenstein* exhibition translated for children and the response was very positive, 72% of the students liked this proposal. As for the selected items, the main reason for their selection was that an item grabbed their attention; others also indicated that they chose an object because they considered it would be easy to write a story or generate activities around it. The reasons for some selections were more personal: "The choice came as a result of a comment made by a relative who accompanied me to the museum about an object in the exhibition related to medicine, since that relative works within that field and told me how that utensil is used today and it caught my attention how it was used a long time ago" (C.S., ST). When asked if they considered the selected item more related to sciences or arts, we can see in Figure 2 how most of the students selected "sciences" or "both" with almost no differences between the two options.

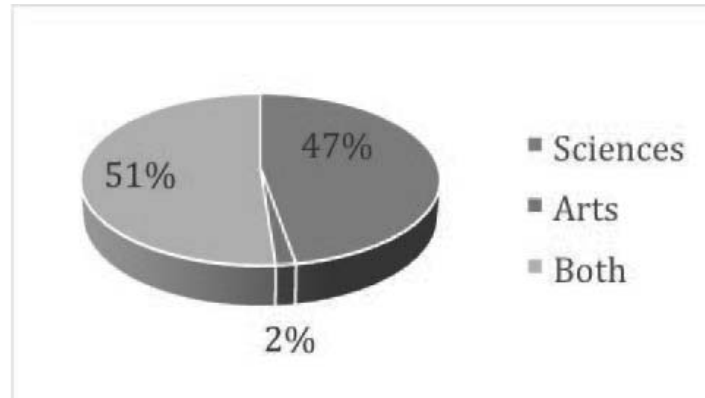


Fig. 2. Responses to the question: "Is the item you selected related to sciences or arts?"  
Source: own research.

When asked if they thought whether the idea of generating a specific catalogue was a good way to present different exhibitions to children, all but one responded affirmatively. The sceptic student said that he would choose something more attractive to children. They were also asked which other cultural activities could be used to generate a catalogue adapted for children. The results are shown in Figure 3. Most of the students proposed touristic tours (81%), sciences and art museums (87% and 77% respectively) or photographic exhibitions (78%), but other cultural activities such as conferences, theatre plays, concerts or a visit to the zoo were also included.

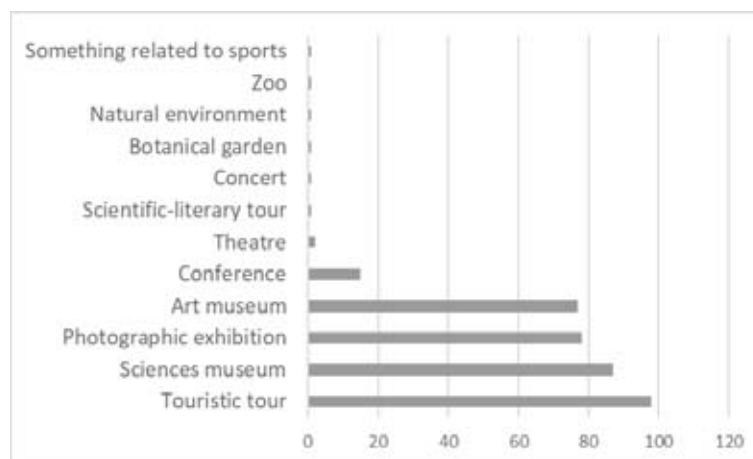


Fig. 3. Cultural activities proposed by pre-service teachers as adequate to generate catalogues for children.  
Source: own research.

All but a couple of students who expressed doubts considered that exhibitions and other cultural activities intended for adults could be adapted for children. The majority of students thought that it could be done just by simplifying contents and/or information: "depending on the topic in question, but in general they can all be adapted, and simply the information should be simpler and more concrete (M.T., ST);" "of course, just adapting the vocabulary and stressing other more general and not so specific aspects (N.C., ST)." Others made a connection with the proposal described here and suggested to make the adaptation for children through short stories or examples and including activities: "Yes, to adapt cultural exhibitions to children, the content should mainly be simplified, giving importance to what is most visual and tangible for them, modifying the vocabulary a little and making it attractive to children, offering them the information in a way to be remembered, for example by telling them a story and doing a related activity (C.F., ST);" "Yes, because the case of Frankenstein is a clear example of how to do it, that it is possible. It is not necessary to take the children to the exhibition but to take the exhibitions to them; making them understand what adults have understood, but in a simpler and visual way, with examples that they can adapt to their daily lives or that they can imagine and conclude with morals, teachings, etc. (A.M., ST);" "Yes, because the content can be summarised and you can also do activities to make it more fun (I.F., LTT)." In some cases, the activity described here made them change their mind: "Maybe before doing the activity about *Frankenstein* exhibition I thought no, but after doing it I realized that it is possible (S.O., LTT)."

As for the integration of sciences and arts in teaching and learning, most of the pre-service teachers (96%) consider this possibility very or quite interesting, while none of them thinks the opposite, as shown in Figure 4.

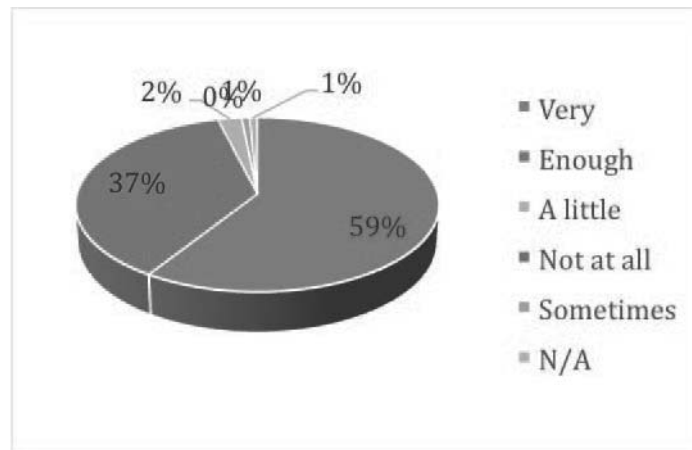


Fig. 4. Responses to the question: "Do you consider interesting to integrate sciences and arts in learning?"

Source: own research.

## CONCLUSIONS

The educational experience described here shows how a cultural activity intended for adults can be adapted for children. Pre-service teachers created a specific catalogue with creative teaching materials for children with related activities for the different items based on an exhibition about *Frankenstein*. Pre-service teachers experienced the exhibition with more intensity due to the necessity to look at the objects with a teacher's vision and not as mere visitors.

The analysis of the catalogue shows that alumni from both subjects had different preferences when choosing an object, although in both groups the items related to directions, in particular the marine compass, were selected most often. Pre-service teachers prepared a variety of activities that could be divided into four groups: knowledge, creativity, reflection and outdoor education, where almost 60% of the activities belonged to those aimed at gaining knowledge about the item or its discipline. We can conclude that the educational proposal here described has been able to develop different content and competences, especially the creativity of our students. It was also a motivating experience, as shown by their opinions, which were positive and more than 70% considered it very formative and interesting. They especially valued the opportunity to prepare activities for children during the didactic transposition and being able to see the exhibit with fresh eyes in a life-long formative journey that has only just begun.

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