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# Teachers and Museum Educators' Views About Inquiry Practices: The Aftermath of a Joint Professional Development Course

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**Abstract:** Current science curricula adopt inquiry as a basic component in their proposals, and at the same time they place emphasis on the non-formal aspect of education, due to the fact that inquiry is easier to be implemented in science centers and museums. In this context, both teachers and museum educators' roles are viewed with a common lens, as though both groups of professionals have critical roles in the success of a school museum visit, they do not necessarily share the same agenda for the visit. In the present small-scale qualitative research, we studied two Greek science teachers and two museum educators who attended a joint professional development course on the Tinkering approach in Milan in the context of an EU funded project. We looked into the impact of the joint course on their views about inquiry and specifically their views about inquiry before and after being exposed to inquiry based Tinkering activities. We also studied their views about the joint course per se. Data collection was based on semi-structured interviews and the participants' notes. The results point both to some different and common points between teachers and museum educators' views. The opportunity to exploit the results in a broader non-formal science education context is also being discussed.

**Keywords**: M*useum educators; Professional development; Teachers; Views about inquiry teaching practices*.

## Introduction

Current science curricula adopt inquiry as a basic component in their proposals, namely, as a prominent teaching -learning proposal. At the same time, they place emphasis on the non-formal aspect of education (NRC, 2012).

Besides formal education, venues such as museums, science centers, botanical gardens, industries, etc., are venues where students may nurture their interest in science and get engaged in inquiry procedures during field trips (NRC, 2009). Handling exhibits and equipment, observing, posing questions, predicting, ending up in conclusions and stating arguments are all inquiry procedures that have been observed in this sort of environments (NRC, 2009). Adopting innovative programs with inquiry features is easier in science centers, science museums and respective venues, due to the non-formal and non-evaluative character of education (Kisiel, 2013).

In this context, the role of both teachers and museum educators are viewed from the same perspective and are in the forefront of a number of EU funded programs such as Tinkering EU: Science capital for all (2017) and Science Inspired (2018). These two groups of professionals are asked to bring students closer to STEM fields, while intriguing them through the

adoption of novel practices both at school and in the museum.

A vast number of studies has investigated various aspects of teachers' practices and particularly their relation to inquiry as a teaching approach (Tseng, Tuan & Chin, 2013; Buehl & Beck, 2014; Janssen, Westbroek & Van Driel, 2014), since current trends in science education place emphasis on pre and in-service teachers' education focusing on the adoption of the inquiry approach (Janssen et al., 2014) and the role of informal science approaches in developing their personal philosophies about science teaching (Skayia, Avraamidou & Evagorou, 2019). However, the application of the recommended inquiry practices seems to be somehow problematic. In particular, science teachers mention both structural (e.g., children's safety, transportation to the venue) and economic difficulties (e.g., transportation cost, tickets) as the main obstacles in organizing site visits. They also refer to the preparation of effective site visits as an additional workload, which deters them from organizing such out-of-school activities more frequently (Tsaliki et al., 2016). On their part, Fitzgerald, Dawson & Hackling (2013) showed that teachers' views are a critical issue regarding the adaptation and implementation of the inquiry method, together with the need of familiarization with inquiry teaching practices.

On the other hand, very few studies have reported on museum educators' practices. In non-formal education settings, museum educators realize the educational agenda of the institution they work at (Tran, 2008) and determine the way students interact with each other and engage in the aforementioned inquiry procedures (NRC, 2009). Put it differently, their practices while implementing the programs shape the learning environment, which either supports or not students' inquiry procedures (Astor-Jack, McCallie & Balcerzak, 2007). Although non-formal learning settings expand the possibilities for science learning beyond those offered in schools, field trips rarely take advantage of the unique affordances of museums, tending to look more like formal learning enacted in a non-formal setting (DeWitt & Storksdieck, 2008). As Allen & Crowley (2014) assert, a major reason for this has to do with the ways that museum educators conceptualize and enact models of learning in the museum, such as the transmission model, which usually reflects their prior learning experiences in schools.

A number of studies about teachers and museum educators' training, underline how difficult it is for educators to leave aside the ways they were taught themselves (Bevan & Xanthoudaki, 2008) and act as mediators rather than didactic tellers (Ash, Lombana & Alcala, 2012). At the same time, it has been found that both teachers (Buehl & Beck, 2014) and museum educators' (Bevan & Xanthoudaki, 2008) engagement in a guided or open inquiry educational program may affect their perceptions about learning at school or / and in a museum and may help them perceive learning as a process that entails students' active involvement. In this direction, a number of science centers involved in EU funded projects such as Tinkering EU: Science capital for all (2017) and Science Inspired (2018), designed novel approaches on teachers and museum educators' professional development (PD) on inquiry teaching. NOESIS, the Science Center and Technology Museum of Thessaloniki, in Greece, has been participating in both projects.

Tinkering is an innovative learning approach which encourages learners to work in an inquiry-based way and pursue an idea or personal goal according to their interests and personal motivations (Bevan, Gutwill, Petrich & Wilkinson, 2015) using diverse tools, materials and methods. The learning dimensions of Tinkering provide a framework for discussing and analysing learning that potentially occurs during Tinkering activities. These dimensions are conceptual understanding, social and emotional engagement, initiative and intentionality, creativity and self-expression, problem solving and critical thinking. The Tinkering approach has the potential to engage students who are facing social, economic or cultural disadvantage with STEM, as it creates a bridging point between a learner's personal interests and experiences and a broad range of possible learning outcomes.

On this ground, bringing teachers and museum educators together in a joint PD course on the Tinkering approach would give them the opportunity to enrich their practices, experiencing themselves inquiry-based activities. Additionally, both groups of professionals would be encouraged to share and reflect on their own teaching practices.

In the present study, we investigated the impact of the joint PD course on two Greek science teachers and two museum educators' views about inquiry. We specifically looked into their views about inquiry before and after being exposed to inquiry-based Tinkering activities during the course. Additionally, we looked into their views about the joint PD course per se.

**Research Questions**

The study reported here seeks to identify teachers and museum educators' views about inquiry, their teaching practices both at school and in the museum and a joint PD course. By examining the aforementioned features, we attempt to gain insight into how teachers and museum educators intend to design and implement activities that would enhance their students' inquiry skills and practices.

The main research question that guided our study was: What is the impact of a joint PD course on teachers and museum educators' views about inquiry?
This question is specified in the following two questions:

1. Which are the teachers and museum educators' views about inquiry before and after participating in a joint PD course?
2. Which are the teachers and museum educators' views about the joint PD course?

## Methodology

**Participants**

In our study, we looked into the views of two science teachers and two museum educators. The two selected teachers have had a quite long teaching experience in junior high schools, 10 and 19 years. One of them has also attended a post graduate course on science education.

These teachers were selected to participate in the specific project due to the fact that they have been visiting NOESIS with their schools for many years and they were eager to participate in the specific project. From this perspective, we chose a 'convenient sample' (Cohen & Manion, 1997), with two teachers sharing a common feature (their willingness to be part of the study). Our sample included both male and female participants.

The two museum educators have studied Science and have been working at NOESIS as guides and facilitators for almost 7 years. One of them is currently attending a post graduate course on science education, as well.

The 3-day PD course took place in MUST (Museo Nazionale Della Scienza e della Technologia Leonardo Da Vinci) in Milan, Italy. MUST is the leading organization in the "Tinkering EU: science capital for all" project. In total, 20 teachers and museum educators from 5 EU countries participated in this course.

Prior to the PD course, they were all given a short guide about the Tinkering approach to study. The content of the guide has been developed by Cambridge University, which is a partner in the Tinkering EU project. The agenda of the course had been developed by the project leader (MUST) in cooperation with Cambridge. As previously stated, reflection was a distinctive part in the daily agenda, as it is recommended by researchers to offer both teachers and museum educators the opportunity to discuss their work with knowledgeable colleagues (Bevan & Xanthoudaki, 2008; Gess-Newsome, 2015).

**Data Collection**

In our study, we selected the case-study method to investigate teachers and museum educators' views (Yin, 1994). We chose the multiple case-study method in particular, in order to investigate different teachers and museum educators' views about inquiry, their teaching practices both at school and in the museum and the joint PD course. Semi-structured interviews were conducted with each of the participants, both prior to and after the PD course, as it is recommended in qualitative studies with few participants (Cohen, Manion & Morrison, 2011) in order to identify the potential changes in their views after attending a PD course.

On this ground, we developed an interview protocol with open ended questions about inquiry, their teaching practices and the joint PD course. (see Appendix). All interviews were conducted at NOESIS and lasted approximately half an hour each. Before conducting the initial interviews, the four participants were given a short guide about the Tinkering approach to read. The interview after the course took place, as planned, right after their return. They were also asked to take notes during the course, trying mainly to reflect on their initial views and practices. Reflection would be included in the daily agenda of the course as a distinctive activity. The specific notes enabled the researchers to cross check the data collected from the interviews conducted after the course.

Overall, data was collected from the interviews before and after the PD course and the participants' notes. In order to analyze our data, we applied methods from a grounded theory approach, an inductive method of constant comparison data analysis (Strauss &Corbin, 1990). Following the steps of this method of data analysis, we codified both the participants' responses and notes, and this resulted in specific themes. The themes that emerged from data analysis, are the following: Adopting the Tinkering approach, Inquiry in practice and PD for both teachers and museum educators. These themes are presented below in detail.

## Results

The results are presented according to the aforementioned identified themes:

**Adopting the Tinkering Approach**

Before the course, the two teachers identified a number of common features between their teaching practices at school and the Tinkering approach

*"…a part of my teaching practice at school shares some characteristics with Tinkering, such as the construction of an object, the playful atmosphere…." (teacher 1)*

*"…the Tinkering approach does not stick to theory. It promotes active engagement – pretty much the way I do things in class." (teacher 2)*

However, after the course, one of them highlighted some obstacles in terms of integrating it into his/ her teaching practices,

"…*adopting the Tinkering approach in class requires perfect time management so that you won't fall behind with the priorities set in the curriculum" (teacher 1)*

The other teacher identified a difference between the Tinkering approach and his/her teaching practices, regarding the level of facilitation or guidance, revealing a more thorough understanding of the Tinkering approach after attending the course

"…*Tinkering activities are less structured than the ones we perform in class…I could be interfering less in class" (teacher 2)*

Before the course, and after reading the Tinkering guide, the museum educator who had been attending a post graduate course on science education identified some common ground between the Tinkering approach and his/her practices in the museum without being more specific

*"… I think that we already put in practice some of the things I've read in the museum" (museum educator 1)*

The other museum educator gave a somehow more elaborated answer and connected the fact that he/she tries to understand the science background of the students setting questions with some of his/her readings

*"…before (facilitating) an educational program, I ask some questions to understand students' science background and their interests – as I've read, this can affect their engagement with the educational activity - so that I can find the way to intrigue them …" (museum educator 2)*

After the course, both of the museum educators thought the approach had a lot in common with their own practices in the museum. One of them, in particular, pointed to the fact that:

"…*as a facilitator in educational programs in the museum, I do not provide answers to those who face some difficulty – I rather point to other options that may help them out.*" *(museum educator 2)*

The following table presents the two teachers and two museum educators' views about the adoption of the Tinkering approach:

Table 1.

Teachers and museum educators' views about the Tinkering approach

| | Before | After |
|---|---|---|
| Teacher 1 | Identifies some common features between Tinkering and his/her classroom practices. | Tinkering requires time management in class. |
| Teacher 2 | Identifies some common features between Tinkering and his/her classroom practices. | Compares the Tinkering approach with his/her classroom practices. |
| Museum educator 1 | Asserts that there are some common features between Tinkering and his/her museum practices. | Asserts that there are some common features between Tinkering and his/her museum practices. |
| Museum educator 2 | Identifies some common features between Tinkering and his/her museum practices. | Identifies some similarities between Tinkering and his/her museum practices. |

**Inquiry in Practice**

Before the course, the teacher, who has attended a post graduate course in science education, acknowledged inquiry and stated his/her preference on open inquiry, claiming

"…*I prefer open inquiry to the guided one, cause, for me, it resembles the way we learn, that is choosing, trying, failing, reflecting. However, I do not adopt it as often as I would like, due to the fact that it's time consuming.*" *(teacher 1)*

After the course, he/she pointed out some difficulties in adopting inquiry in class

*"After experiencing the Tinkering activities, I still like open inquiry more, though it is difficult to adopt it in class mainly due to time restrictions." (teacher 1)*

The other teacher did not know anything about inquiry before the course. After the course, he/she asserted that there are some common features between inquiry and the Tinkering approach, most probably based on his/her readings and firsthand experiences during the course

*"I can see some similarities between inquiry and Tinkering…" (teacher 2)*

and claimed that inquiry is better implemented in a museum setting

*"…inquiry can be more easily adopted in the museum than in class. Also, a museum is more likely to have the financial resources to design the proper environment for these sort of activities (eg. Tinkering) than a school is." (teacher 2)*

Before the course, the museum educator, the one who has been attending a post graduate course on science education stated that inquiry would be better placed in a museum setting

*"Inquiry is better suited in a museum context." (museum educator 1)*

while the other museum educator knew nothing about inquiry.

After attending the course, the latter stated that:

*"…inquiry does a lot more than helping students learn. It intrigues them and helps them experience the nature of science…" (museum educator 2)*

while the other museum educator was more specific, pointing out

*"I do not think inquiry can be adopted in class especially after primary school due to the hectic curriculum."*

The following table presents the two teachers and two museum educators' views about the implementation of inquiry:

Table 2.

Teachers and museum educators' views about inquiry in practice

| | Before | After |
|---|---|---|
| Teacher 1 | States his/her preference on open inquiry. | States his/her preference on open inquiry, pointing out some practical difficulties regarding its implementation at school. |
| Teacher 2 | He/she does not know inquiry. | He/she sees some similarities between Tinkering and inquiry, placing the latter in a museum setting. |
| Museum educator 1 | He/she states that inquiry is for museums | He/she claims that inquiry cannot be adopted after primary school. |
| Museum educator 2 | He/she does not know inquiry. | He/she asserts that inquiry is intriguing. |

**PD for Both Teachers and Museum Educators**

Before the course, both teachers and museum educators expressed the belief that only good things could derive from a joint PD course:

*"It's a brilliant idea. Each group – teachers and museum educators – can offer experience to the other..." (teacher 1)*

*"Such initiatives are really useful and can lead to synergies." (teacher 2)*

*"Being together and talking about the different way we do things in the museum and at school can be constructive for both." (museum educator 1)*

*"…exchanging views can be interesting and useful for all of us." (museum educator 2)*

After the course, the two teachers verified their initial statements, pointing out the interaction of the two groups:

*"…I saw it working. I think that both groups (teachers and museum educators) can offer useful experience from various aspects of the learning process." (teacher 1)*

Likewise, the museum educators enjoyed this experience and one of them claimed that

*"…exchanging views and experiences enables each group to gain a multi-faceted perspective about teaching and learning." (museum educator 2)*

The following table presents the two teachers and two museum educators' views about professional development for both teachers and museum educators:

Table 3.

Teachers and museum educators' views about joint PD

| | Before | After |
|---|---|---|
| Teacher 1 | He/she claims that exchanging experiences would be useful for all. | He/she asserts that initial expectations were verified. |
| Teacher 2 | He/she argues that a joint PD can lead to synergies. | He/she thinks positive of such opportunities. |
| Museum educator 1 | Exchanging views and experiences scores highly for him/her. | He/she underlines that it was a great experience. |
| Museum educator 2 | He/she claims that exchanging views would be useful for all. | He/she claims that everyone will gain a multi-faceted perspective about teaching and learning." |

## Discussion

In our research, we studied two science teachers and two museum educators who attended a joint professional development course on the Tinkering approach. In particular, we studied their views about inquiry before and after being exposed to inquiry based Tinkering activities, as well as, their views about the joint course per se.

The results of our study showed that through their engagement in the joint professional development course on the Tinkering approach in the context of an EU funded project, the two teachers and the museum educators developed more articulate views about the Tinkering approach and their inquiry practices both at school and in the frame of non-formal science education.

In particular, the findings of this study revealed that both the teachers and the museum educators claim that inquiry is better adopted in a museum context than at school, mainly due to time restrictions imposed from the school curriculum. This is in accordance with what research says about inquiry and the settings more suitable for someone to adopt it (Kisiel, 2013).

Another remark on the results of this study could be that only two of the participants were acquainted with the inquiry approach. The science teacher and the museum educator who knew about inquiry had attended or were attending, at the time the research took place, a post graduate course on science education. This fact could be considered as a tentative indication of the importance of the education that is provided in such courses which focus on the manners that science education could be more efficient. It also seems that years of teaching experience could not be considered as equivalent to these education projects, since, for instance, the teacher that did attend a post graduate course had half the years of teaching experience compared to the second teacher.

With respect to their views about adopting and adapting inquiry as a teaching approach, a slight difference was identified between the teachers and the museum educators, as it would most probably be expected, due to the different professional perspectives. One of the teachers commented on his/her teaching practices before the course, while both teachers referred to their teaching practices at school after the course. The other teacher claimed that he/she could be less instructive with his/her students and the science teacher that he/she was not implementing inquiry as often as he/she wanted due to time constraints imposed by the school curriculum. These findings are in accordance with Skayia et al. (2019) who claim that the inclusion of informal learning in teachers' preparation has the potential to support them in reconstructing their ideas about science and science teaching in ways that are aligned with current reform efforts. On the other hand, while none of the museum educators commented on his/her practices in the museum before the course, after it ended, one of them reflected on his/her practice in the museum and tried to identify some common ground between inquiry and his/her own practice. Given the opportunity to reflect during the course, seemed to have an impact both on his/her ability and will to reflect on their practice. This is in line with research findings that support the importance of reflection for museum educators (Bevan & Xanthoudaki, 2008) during a training course. From another perspective, it is worth mentioning that it seems that the two teachers were somehow more familiar with reflection, while the museum educators were not. This interpretation would highlight another important issue, that of museum educators' training. However, this is not something that the present study deals with.

Overall, the PD course on the Tinkering approach had an impact on the way the participants perceived inquiry afterwards, and especially for the two participants that did not attend any post graduate course on science education, that is, one of the teachers and the museum educator who did not know about inquiry beforehand. On the one hand, this teacher reflecting on his/her own teaching practices realized that he/she could give his/her students a more active role in class. Regarding the museum educator, he/she seemed to realize the potential of adopting an inquiry approach in the museum that would help him/her intrigue visitors. Both cases seem to verify the conclusions of previous studies on the effect of a training course on inquiry (Bevan & Xanthoudaki, 2008; Buehl & Beck, 2014) on the way both teachers and museum educators perceive students' active involvement in the learning process.

The fact that both the two teachers and the two museum educators commented on the positive things that have derived from this joint PD course cannot be supported or confronted with other research results, as to the best of our knowledge, there is no respective precedent.

From our perspective, the aftermath of this joint course is twofold. On the one hand, with respect to the inquiry approach, the course gave the opportunity to both groups to expand their teaching practices portfolio and learn to elaborate on their teaching practices through reflection. On the other hand, it brought closer two groups of professionals that up till now had been treated separately, though teaching is in the heart of their professions.

Though this is a small-scale qualitative study, there is an extra value in our findings that should be considered in light of the fact that the two groups of professionals, namely the teachers and the museum educators, were studied before and after attending together a PD course on a novel teaching approach. In particular, the fact that both teachers and museum educators were in favor of this joint PD course, should be carefully considered and not left unexploited. Bringing together formal and non-formal educators in a PD course may prepare the context for the two groups of professionals to work collaboratively towards the integration of formal and non-formal education.

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## References

Allen, L.B., & Crowley, K.J. (2014). Challenging Beliefs, Practices, and Content: How Museum Educators Change. *Science Education 98,* 84-105. https://doi.org/10.1002/sce.21093

Astor-Jack, T., McCallie, E., & Balcerzak, P. (2007). Academic and Informal Science Practitioner Views About Professional Development in Science Education. *Science Education, 91*(4), 604-628. https://doi.org/10.1002/sce.20205

Ash, D. B., Lombana, J., & Alcala, L. (2012). Changing practices, changing identities as museum educators. In *E.* Davidsson, A. Jakobsson, (eds.), *Understanding Interactions at Science Centers and Museums: Approaching Sociocultural Perspectives,* 23–44. Sense Publishers

Buehl, M.M., & Beck, J.S. (2014). The relationship between teachers' beliefs and teachers' practices. In H. Fives & M.G. Gill (Eds.), *International Handbook of Research on Teachers' Beliefs*, (pp. 66-84). Routledge, NewYork. https://www.routledgehandbooks.com/doi/10.4324/9780203108437.ch3

Bevan, B., & Xanthoudaki, M. (2008). Professional development for museum educators: Underpinning the underpinnings. *Journal of Museum Education, 33*(2), 107 – 119. https://doi.org/10.1080/10598650.2008.11510592

Bevan, B., Gutwill, J. P., Petrich, M., & Wilkinson, K. (2015). Learning Through STEM-Rich Tinkering: Findings From a Jointly Negotiated Research Project Taken Up in Practice. *Science Education, 99*(1), 98–120. http://doi.org/10.1002/sce.21151

Cohen, L., Manion, L., & Morrison, K. (2011). *Research methods in education* (7th ed.). Abington, Oxon: Routledge. https://doi.org/10.4324/9780203224342

Cohen, L. and Manion, L. (1997). *Research Methods in Education*. 4th ed. London: Routledge.

DeWitt, J., & Storksdieck, M. (2008). A Short Review of School visits: Key Findings from the Past and Implications for the Future, *Visitor Studies, 11*(2), 181-197. https://doi.org/10.1080/10645570802355562

Fitzgerald, A., Dawson, V., & Hackling, M. (2013). Examining the beliefs and practices of four effective Australian primary science teachers. *Research in Science Education, 43*, 981–1003. https://doi.org/10.1007/s11165-012-9297-y

Gess-Newsome, J. (2015). A model of teacher professional knowledge and skill including PCK: Results of the thinking from the PCK Summit. In A. Berry, P. Friedrichsen, & J. Loughran (Eds.) *Re-examining Pedagogical Content Knowledge in Science Education, 28-*42. https://doi.org/10.1080/09500693.2016.1265158

Janssen, F.J.J.M., Westbroek, H., & Van Driel, J.H. (2014). How to make guided discovery learning practical for student teachers? *Instructional Science*, 42(1), 67-90. https://www.learntechlib.org/p/167982/.

Kisiel, J. (2013). Introducing Future Teachers to Science Beyond the Classroom. *Journal of Science Teacher Education, 24*(1*)*, 67-91. https://doi.org/10.1007/s10972-012-9288-x

Kisiel, J. (2005). An examination of fieldtrip strategies and their implementation within a natural history museum. *Science Education, 90*(3), 434 – 452. DOI: 10.1002/sce.20117

National Research Council (2009). *Learning Science in Informal Environments: People, Places, and Pursuits.* Committee on Learning Science in Informal Environments. P. Bell, B. Lewenstein, A. W. Shouse, and M. A. Feder, (Eds.) Board on Science Education, Center for Education. Division of Behavioral and Social Sciences and Education. Washington, DC: The National Academies Press. DOI: https://doi.org/10.17226/12190

National Research Council. (2012). A framework for K-12 science education: Practices, crosscutting concepts, and core ideas. Washington, DC: National Academy Press.

Skayia, A., Avraamidou, L., & Evagorou, M. (2019). How Preservice Elementary Teachers Develop Their Personal Philosophies About Science Teaching: The Role of Informal Science Approaches. *Journal of Research in Science, Mathematics and Technology Education, 2*(2), 71-84. doi:10.31756/jrsmte.222

Strauss, A., & Corbin, J. (1990). *Basics of qualitative research, grounded theory procedures and techniques*. Sage publications.

Tran, L.U. (2008). The work of science museum educators. *Museum Management and Curatorship, 23*(2), 135-153. https://doi.org/10.1080/09647770802012219

Tsaliki C., Malandrakis G., Zoupidis A., Karnezou M., & P. Kariotoglou (2016). Science teachers' profile changes concerning non-formal education design. In J. Lavonen, K. Juuti, J. Lampiselkä, A. Uitto & K. Hahl (Eds.), Electronic Proceedings of the ESERA 2015 Conference. *Science education research: Engaging learners for a sustainable future, Part 14 Strand 14* In-service science teacher education, continued

professional development, Co-editors: Amanda Berry & Digna Couso, (pp. 2370-2377). Helsinki, Finland: University of Helsinki. ISBN 978-951-51-1541-6.

Tseng, C.H., Tuan, H.L., & Chin, C.C. (2013). How to help teachers develop inquiry teaching: perspectives from experienced science teachers. *Research in Science Education*, *43*(2), 809–825. https://doi.org/10.1007/s11165-012-9292-3

Yin, R.K. (1994). *Case study research: Design and methods* (2nd ed.). Thousand Oaks, CA:Sage.

## Appendix

Interview protocol

1 – Reading the Tinkering guide, do you identify anything common with your approach in class / the museum?

2 – Do you think that the setting (classroom / museum) affects the teaching approach a teacher / a museum educator implements?

3 – The Tinkering approach has a lot in common with open inquiry. What do you think of inquiry as a teaching approach? (what do you know about it, do you implement it in class / the museum, do you think it's useful and/or necessary and why)

4 –What do you think of such initiatives that bring teachers and museum educators closer and inform / teach them educational approaches?

5 - What are your expectations or arguments that you may possibly hold about this co existence of teachers and museum educators?

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