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Guided School Visits to a Research Center: Perspectives from Teachers and Staff

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Abstract
This study investigates (i) the educational program offered by one of the largest research centers in Greece and (ii) the teachers' and staff's perspectives for the school visits. Data came from interviews of teachers, staff of the research center and observation of the school visits. Though the majority of the teachers were satisfied of the visit, and they perceived the trip as a unique experience for their students, it was mostly inconsistent with recommendations of informal science teaching literature, as science teachers perceived the visit as an isolated one-day occurrence with no connection to the curriculum and no intention of planning any pre- or post-visit activities. This fact, combined with the demonstrated gap between teachers' and staff's perspectives, gave little or no learning orientation to the visits. Finally, this study assists in developing guidelines that would serve both teachers and research centers in collaborating together for better school trips.

Keywords
non-formal science education, out-of-school contexts, research centers, school visits

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State of the literature
- Research centers offer a unique environment where students have the opportunity to learn about cutting-edge research topics.
- Literature indicates the context of the out-of-school setting as one of the factors that determines the effectiveness of school field trips.
- Though school visits to other settings of non-formal science education have been extensively studied, there is lack of studies regarding visits to research centers, especially from teacher's perspective.

Contribution of this paper to the literature
- The investigation is both descriptive and explanatory in nature.
- It intends to describe the phenomenon of school visits to research centers from teachers' perspective and offer an understanding concerning the different beliefs and attitudes between science teachers and staff of the research center.
- At the same time this study attempts to make a further step to the understanding of the design of school visits to a research center and assist in developing guidelines that would serve both teachers and research centers in collaborating to create better school trips.

Introduction
Nowadays great emphasis has been placed on learning that can take place in organized science venues outside school, as a lot of studies recognize the potential of such places to provide many benefits to their visitors, both in cognitive and emotional level (Dewitt & Storksdieck, 2008; Mujtaba et al., 2018). Such places can stimulate the interest and curiosity of the students and provide an incentive for further engagement with science, much more than classroom teaching (Neresini et al., 2009; Pedretti, 2002; Salmi, 2003).

However, in order to maximize students' benefits not only at an emotional but at a cognitive level as well, teachers have to recognize the importance of their role and consider a number of recommendations about best practices that can lead to the effectiveness of visits to non-formal environments as learning experience. For instance, it is suggested that teachers have to become familiar with the setting before the visit, inform their students about the expected learning outcomes, plan pre- and post-visit activities, and take advantage of the uniqueness of the setting (Dewitt & Storksdieck, 2008).

There are numerous studies about visits to science museums and science centers that have been undertaken (Anderson & Zhang, 2003; Garip & Bulbul, 2014; Karnezou et al., 2021; Persson, 2000; Rennie & Williams, 2002). Some conditions under which visits to science museums and centers take place are quite similar to the conditions during visits to research centers, though the results from these studies also demonstrate the necessity for more efforts to try new methodological solutions and to gather further empirical evidence.

At the same time there are some crucial differences between research centers and other organized science venues. These settings provide students with the unique opportunity to be engaged with cutting-edge research topics and become familiar with a variety of up-to-date technological applications, which makes the learning of science more attractive (Schank et al., 2009). At the same time, the visitor will not meet any exhibitions or artifacts, as is usually the case in other non-formal settings, such as museums and science centers, but he will meet experimental set-ups. Research centers usually have no educational staff for school visits, so researchers who work there are responsible for guiding students inside their labs, thus providing students with the opportunity to talk to a researcher and learn about his job.

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Despite the fact that school visits to other settings of non-formal science education have been extensively studied, there is lack of studies regarding visits to research centers (Dimopoulos & Koulaidis, 2006; Neresini et al., 2009), especially from teacher's perspective. So, this study intends to make a further step in this direction, by investigating

a. how a school visit to a research center is designed and
b. how do teachers perceive the class visit to the research center.

More specifically the detailed research questions of the current study are the followings:

1. What are the aims of a school visit in a research center as defined by the provider?
2. What are teachers' views about a class visit to a research center and their role thereby?

Theoretical Background

There is a need to integrate new scientific and technological developments in science teaching, especially if one considers the ever-changing and renewed scientific and technological knowledge. Cutting-edge research topics promote students' understanding of the nature of science, as well as their familiarity with the authentic practices of scientific research (Hansson et al., 2019; Wong et al., 2008). Such topics can involve students in a discussion about how scientific knowledge is produced and the limitations of scientific research, contributing to the understanding aspects of the nature of science (Glasson & Bentley, 2000; Karisan & Zeidler, 2017). In addition, according to Kolstø (2001), cutting-edge research topics consist of the ideal framework for discussion about socio-scientific issues.

Out-of-school learning environments, such as research centers, museums, science centers, etc. can significantly contribute to this direction. Especially, research centers constitute a unique environment where students have the potential to come in contact with cutting-edge research topics, as they offer authentic conditions of scientific knowledge development. The special characteristics of these settings differ substantially from other non-formal settings such museums and science centers, which have extensively been studied (Anderson et al., 2000; Behrendt & Franklin, 2014; Falk & Dierking, 2000; Faria & Chagas, 2012; Griffin, 1998).

Results from a cross-national study of visitors of all ages to four large research centers in Europe showed that effects on learning of scientific concepts are not so clear (Neresini et al., 2009). The visits mostly seem to reaffirm visitors' prior attitudes and images related to the centers. The findings imply that these visits offer some learning potential and for school students increase motivation to enter a scientific profession, but in terms of altering visitors' images they seem rather ineffective. At the same time, Dimopoulos and Koulaidis (2006) after studying school visits to a research laboratory, they found that students' knowledge about the techno-scientific content seem to move from a state of full ignorance before the visit, to a state of cognitive confusion characterized by either the mixing of correct and false elements or the incompleteness of the acquired information after it. In general, they concluded that school visits to research centers offer considerable educational potentials possibly overlooked even by the science teachers organizing them.

Literature places special emphasis on the role of the teacher making explicit recommendations about best practices that can maximize the effectiveness of field trips as learning experiences (Dewitt & Storksdieck, 2008). Before the visit teachers are encouraged to become familiar with the setting before the trip, clarify the learning objectives, inform students about the expected learning outcomes, design pre-visit activities that offer students the necessary knowledge or capacities and if possible, with collaboration with the setting (DeWitt & Osborne, 2007; Eshach, 2007). During the visit teachers should play an active role by focusing student attention on specific parts of the visit and encouraging social interactions not only among students but also between students and adults (Eshach, 2007; Tal, 2001). After the visit teachers should reinforce the school field trip experience by planning and conducting follow-up activities based on the content of the visit as well as the pre-visit activities and allowing students opportunities for sharing and feedback (Lucas, 2000; Orion & Hofstein, 1994).

From the above, it emerges a particular interest for science education of how school and out-of-school education can be appropriately combined, especially on learning cutting-edge research topics. The investigation is both descriptive and explanatory in nature. It intends to describe a phenomenon, such as school visits to research centers from teachers' perspective and offer an understanding concerning the different beliefs and attitudes between science teachers and staff of the research center. At the same time this study attempts to make a further step to the understanding of the design of school visits to a research center and assist in developing guidelines that would serve both teachers and research centers in collaborating to create better school trips.

The Study

The Setting

Foundation for Research and Technology in Hellas (FORTH) was selected for the needs of this study. FORTH is one of the largest research centers in Greece with a reputation as a top-level research institution worldwide. It consists of eight research institutes, which are located in several areas of Greece (Heraklion, Rethymnon, Chania, Patras, and Ioannina). Its headquarters and central administration are based in Heraklion, Crete. Specialized scientific research in areas of major technological and economic interest, such as nanotechnology, robotics, biotechnology, astrophysics, etc. is being conducted. Although the main aim of the Foundation is research and innovation, it nevertheless provides a basis for diffusing the results of this research by organizing once a year "researcher's night" and summer schools and on a weekly basis visit programs for schools, which is the case of the present study.

More specifically, once a week schools have the opportunity to visit four research institutes that are located in Heraklion: Institute of Electronic Structure and Laser (IESL), Institute of Molecular Biology and Biotechnology (IMBB), Institute of Computer Science (ICS), and Institute of Applied and Computational Mathematics (IACM). The target student populations that visit FORTH are secondary school students (grades 10-12) with a geographical distribution that covers the whole country. All the school trips are scheduled and pre-organized by an employee of FORTH, who is responsible for school visits. It is also worth noting that the visits are charge free and that there are no professional guides for the needs of the school trips, but students are guided by researchers that work at FORTH.

Structure of the Visit

At the moment the school bus enters the parking lot, the teachers meet the person in charge of school visits at FORTH. The visit is structured into two main parts. In the introductory phase all the students along with their teachers are taken to the auditorium of the foundation, where they attend a presentation in the form of an oral lecture with slides and videos. The presentation starts with the institutional structure of the research center and continues with the research conducted by IACM and some of its everyday technological applications. At the end of the lecture, there is a quiz of ten questions for the students and also time for extra questions. After the presentation, which lasts about 45 minutes, there is a 20-minute break where students have the opportunity to rest in the café of the institution.

At the second phase of the visit the students are divided in three groups and are guided in the labs of IESL, IMBB and ICS in a row. The tour is guided by the researchers of FORTH and it lasts about an hour, which means that the duration of the tour in each institution is about 20 minutes. During the tour students have mainly the opportunity to talk to researchers about current research topics and their possible applications in every-day life. The purpose of the visit, as determined by FORTH, is the students during this two-hour visit to see as many labs and as many technological applications as possible.

Participants

This study refers to school visits that took place at FORTH during the school year 2016-2017. More specifically, school visits started at the end of November 2016 and were completed in April of the following year. On a weekly basis, one school visit took place at FORTH and so a total of 10 schools participated in the study. All the schools were regular public schools from urban areas, small and bigger cities as well, as shown in **Table 1**.

Table 1. Characteristics of each school visit.

	Type of school	Area	# Science teachers	# Students	Age
S1	Vocational high school	Small city	1	50	16-18
S2	General high school	Urban	1	30	17
S3	General high school	Big city	1	38	18
S4	General high school	Urban	1	30	16-18
S5	General high school	Small city	1	40	18
S6	General high school	Big city	2	40	17
S7	General high school	Big city	1	50	18
S8	Vocational high school	Big city	1	40	18
S9	Experimental high school	Small city	1	44	18
S10	Experimental high school	Big city	1	17	18

Data Collection

Data collection is mainly based on observations of all the school visits that took place at FORTH. So as to enrich our data, interviews were conducted both with the teachers and the person in charge for the school visits at FORTH.

Out of a total number of 10 school visits which were observed, 11 science teachers were selected to be interviewed for this study. In some cases, there were more than one teacher accompanying the students, but only the ones that taught science courses were selected for the needs of our study. The special demographic details of the participating teachers are shown in **Table 2**.

Table 2. Characteristics of the science teachers accompanying the school visits.

	Gender	Years of teaching experience	Type of school	Area
T1	Male	25	Vocational high school	Small city
T2	Female	12	General high school	Urban
T3	Male	20	General high school	Big city
T4	Male	30	General high school	Urban
T5	Female	15	General high school	Small city
T6	Male	27	General high school	Big city
T7	Male	5	General high school	Big city
T8	Female	14	General high school	Big city
T9	Female	12	Vocational high school	Big city
T10	Male	11	Experimental high school	Small city
T11	Male	4	Experimental high school	Big city

Observations

In order to record the activities that took place during the school visits, an observation sheet was developed, focused on nine dimensions based on the work of Sajons and Komorek (2018). The nine dimensions of the observation were the purpose of the visit; students' prior knowledge, the orientation of the activities, the extent of students' guidance, the self-assessment of effectiveness, the relation of the visit with the curriculum, the interdisciplinarity of new knowledge, the orientation in the understanding of a framework and the role of the staff and the teachers as well.

More specifically, the first dimension examines who determines the purpose of the visit, if the students are informed about this purpose and whether the activities that take place during the visit are oriented towards this purpose or not. The second dimension examines to what extent the activities are designed based on students' prior knowledge. The third dimension examines if the sequence of the activities leads to a specific result, or the activities are independent of one another. The fourth dimension examines whether students are strictly guided, or they are free to choose what to see. The fifth dimension examines to what extent and in what way there is feedback in students' questions or comments. The sixth dimension has to do with relationship between the visit and school curriculum. The seventh dimension examines whether new knowledge is produced independently of science courses and to what extent is a combination of Physics, Chemistry, Biology, etc. The eighth dimension examines whether the principles and concepts of science are used as a means of understanding some technological applications or vice versa. Finally, the ninth dimension has to do with the role of the staff of the research center and the role of the teacher as well.

Interviews

All the interviews with the teachers were structured and followed a written protocol based on the studies of Cox-Petersen et al. (2003) and Griffin and Symington (1997). The questions addressed the preparation that took place at school prior the visit; the evaluation of the visit; and the post-visit activities at school, as shown in **Table 3**. Eleven teachers, who gave their consent, were interviewed at the break and/or at the end of the visit (see **Appendix A**).

Table 3. Interviews with teachers: Main axes and sub-categories.

Main axes	Sub-categories	Items (Appendix A)
Preparation	Purpose for the visit	1a & 1b
	Pre-visit activities at school	2
The visit	Relation to the curriculum	3
	Perception of the visit	4, 5, & 6
	Suggestions for improvement	7
Post-visit	Follow-up activities at school	8

At the same time, an interview with the person in charge for the school visits at FORTH took place. This interview followed a protocol (see **Appendix B**), which aimed to study how FORTH designs and evaluates the school visits. The main axis of the interview is presented in **Table 4**.

Table 4. Interview with the person in charge at FORTH: Main axes and sub-categories.

Main axes	Sub-categories	Items (Appendix B)
Purpose for the visit	Goals	2
Design of the visit	Criteria for the activities	1
	Knowledge transformation	4
	Students' special characteristics	6
Perception of the visits	Goals	3
	Students' difficulties	5

Due to the exploratory nature of the study, qualitative methods of content analysis were used (Mayring, 2015). Data analysis started with the observation sheets, so as to have a deep insight of the content of the visit, according to the nine dimensions mentioned above. Afterwards, the verbal transcription of the teachers' interviews followed. All answers were read thoroughly and were grouped according to their relevance with the three main axes and their subcategories presented in **Table 3**. Then, the interview with the person in charge of school visits at FORTH was transcribed. After a thorough reading of his answers, they were grouped as in **Table 4**.

Finally, the observation sheet data were crosschecked with those from the transcribed interviews, with regards to their relevance to the research questions:

a. aims and content of the school visits and
b. role of the teachers.

Findings

Observation of the Visit

The observation of the visits, which is analyzed based on the nine dimensions mentioned above, revealed that the purpose as well as the content of the tour is solely determined by FORTH. The orientation of the visit is to present to the students as many labs as possible. The structure and the content of the tour is the same for all school visits and independent of the type of the school, the age of the students, students' prior knowledge or school curriculum. There is a strict schedule that must be followed by students and teachers, which does not allow them to have a choice in what they will see or how much time they will spend in each lab.

At the same time, there is no orientation of the activities the students follow, and each activity is independent of the previous one, as greater emphasis is given on students understanding of the interdisciplinary nature of science rather than the learning of a specific scientific content. The

principles and concepts of science are mainly used as a means of understanding FORTH's technological applications.

Finally, as far as the role of the guides of the institute is concerned, the researchers were very friendly and eager to answer to any question of the students. On the other hand, the teacher's role had to do more with behavior management and organizational issues. Teachers tried to help the researcher mainly by watching the students and telling them what to do following the guide's requests.

Teacher's Perspective

Teachers' perspective refers to their views concerning the preparation that took place at school prior the visit; the evaluation of the visit; and the post-visit activities at school, as reflected during their interviews.

Preparation

According to teachers' interviews (see **Appendix A**, item 1), most of the teachers easily defined a goal of their visit at FORTH, but only few reported as the purpose for the visit the learning of scientific content. Most of them provided general answers to the purpose of their visit at FORTH, such as "becoming familiar with a research institute" or "talking to researchers". In one case the teacher stated that it was the students that suggested him to visit FORTH and he just arranged the visit. More specifically the distribution of the various answers for the purpose of the class visits as expressed by the teachers is presented in **Table 5**.

Table 5. Purposes for class visits at FORTH as expressed by teachers (NoT: Number of teachers).

Purpose	NoT	Examples
Students' familiarization with a research institute	5	"It is the first time they (students) visit a research center, so (I expect them) to see what a research center is."
Learning of cutting-edge research topics	5	"So as (the students) to learn about the continuous development of research and technology."
Talk to researchers	2	"Our expectation was (the students) to talk to scientists."
Career guidance	2	"We've chosen FORTH, so as students to be informed about the chances they have to work there after their studies."
Students' inspiration	1	"It (FORTH) could inspire students."

The fact that none of the teachers referred to a well-defined learning purpose could be also combined with their answers to the question about the content of the visit and the way it addresses what the students had been recently taught in the classroom (see **Appendix A**, item 3). None of the teachers identified such a match, as they perceived the visit as a generally educative experience.

Finally, none of the teachers had planned any pre-visit activities connected with the class curriculum. Four of them reported that they merely informed their students about FORTH in general, such as its location, areas of research and so on.

The visit

In order to look at teachers' perception of the visit, we asked the teachers to rate the visit, name what they liked most and least about the visit and also to make suggestions for improving the trip in order to be more relevant to their students interests and knowledge (see **Appendix A**, items 4-7).

The teachers' general feedback was very positive, as they rated the visit with 4.1/5, according to item 4 (**Appendix A**). What they liked most about the visit was the tour inside the research laboratories, as well as the fact that their students had the opportunity to talk to the researchers and the researchers were very friendly and eager to answer to all their questions.

> What I liked most was the fact that the kids talked directly to the researchers, inside their labs and that the scientists explained to us the projects they are currently working on.

Despite their high rate of the visit, teachers had a lot of suggestions for improving the school visit. As presented in **Table 6**, they suggested that the visit could include more hands-on activities and the topics of discussion could be closer to their students' interests. On organizational issues teachers suggest smaller groups of students and a longer duration of the visit. Finally, one of the teachers recommended that it would be very helpful for the students to be informed somehow before the visit at FORTH.

Table 6. Teachers' suggestions for improving class visits at FORTH (NoT: Number of teachers).

Suggestions	NoT	Examples
More hands-on activities	4	"Students always listen to theories… it's a pity that they did not do an activity themselves."
Topics closer to students' interests and age	3	"Some topics were not close to the students' knowledge and their age."
Informing students prior the visit	1	"Students should be informed prior the visit."
Smaller groups of students	1	"Students should be divided into very small groups, so that they could be engaged in an activity."
More time	1	"The visit to ICS was too short."

Post-visit activities

The vast majority of the teachers claimed that they have no intention to do any follow-up activities in the classroom. Only two out of the eleven teachers stated that they will have a brief talk with the students when they get back in the classroom.

FORTH's Perspective

The person in charge of the school visits at FORTH described his perspective regarding the purpose of the school program, how the visit was designed and his personal perception of the school visits.

Purpose for the school visits

The interview with the person in charge of the school visits at FORTH revealed his own perspective on the visits that take place there. By visiting the labs and talking to researchers, students become aware of innovative, cutting-edge research. According to him, the main purpose for students is to understand how a research center works and how research results are transferred to our everyday lives.

> The aim for students is to understand how a research center works, how research results are transferred to our daily lives and what is the contribution of each research sector to the development of technological applications, something useful for their future professional career.

Design of the visits

As far as the scientific knowledge produced at FORTH, an effort is made to connect this knowledge with school knowledge. To the question of how scientific knowledge is transformed to school knowledge (see **Appendix B**, item 4), the interviewee replied that this is a very complicated process, making a very rough description of how this is obtained.

> In school visits at FORTH, this (knowledge transformation) is achieved through their experience. During the visit, students connect the scientific subjects that are taught in the classroom with the scientific fields of the research that is carried out at FORTH. Thus, they realize that textbook knowledge has arisen in many cases either from the scientific curiosity of a researcher in a laboratory, or from his need to find a solution to a daily problem.

As far as the content of the tour is concerned (presentations, posters, activities), the interviewee replied that this is designed based on the age and the specific needs of each group.

Perception of the visits

Generally, he thinks that students meet no difficulties during the visit, as they have been informed prior the visit by their teachers. He believes that school visits at FORTH are successful as the aims set are obtained.

> They (students) usually meet no difficulties as any questions that arise during their visit are solved by the researchers or their accompanying teachers.
>
> […] Considering the positive response of the students and their teachers at the end of the school visit, we believe that a significant percentage of the objectives of the educational program are met.

Discussion

The results of the present study could form a first empirical basis for the evaluation of school visits to research centers from teachers' and staff's perspective. Our findings indicate that there was little evidence of a cognitive orientation when the teachers of this study planned and carried out the school visits at FORTH. The majority of the teachers interviewed for the study perceive the trip as a unique experience for their students to visit a research institute, talk to researchers and learn about their job. These findings are not consistent with other studies conducted worldwide to other out-of-school venues (Griffin, 2004; Griffin & Symington, 1997; Henriksson, 2018; Tal & Steiner, 2006), which indicate that teachers usually intend to provide enrichment in science, support classroom-based learning and encourage social experiences. The uniqueness of the setting, which significantly differs from science museums and science centers that are studied in previous studies, could be a reasonable assumption for this divergence. The confrontation with the scientific reality and not with a reproduction of it, the conversation with the researchers and the visit to their labs seem to be highly recognized by the accompanying teachers as unique affective benefits for their students. This appreciation of the visit is also empowered by the fact that the vast majority of the teachers declared themselves highly satisfied after the visit.

At the same time another evidence that reinforces the fact that the school visits had no, or little learning orientation is based on the fact that none of the teachers connected the class visit to the curriculum, nor did they plan any pre-visit activities. Only 36% of them provided their students with some technical information about FORTH. Literature draws more or less the same picture: even when they are aware of the importance of pre-visit activities, they rarely prepare their students prior the school visit. A reason for that could be the structure and the content of the visit itself. Via observation of the school visits at FORTH, it became obvious that the tour was designed in such a way so as to enable students to visit as many labs as possible. It is typical that during one-hour students visited three different institutes (IESL, IMBB, and ICS) of FORTH and their labs, which emphasizes "breadth" and not "depth" of scientific knowledge. According to literature, it is preferable to investigate one topic in depth focusing on fundamental concepts, rather than spending time on a large number of subjects, isolated facts, and numerous topics (NRC, 1996; New Standards Committee, 1997). Surprisingly the person in charge of school visits in FORTH claimed that the students meet no difficulties during the visit because they have been prepared prior the visit by their teachers. This statement highlights the fact that neither he nor the researchers had ever a substantial communication with the teachers.

Another fact that limits the learning potential of the visit is the role of the teachers during the visit as they do not take an active role but they "follow tradition" (Tal, 2001) by being primarily concerned with organizational issues. In some cases, when the total amount of students was divided in three groups, the accompanying teacher was not a science teacher, so he was not capable of suggesting ideas, making connections to the curriculum, or explaining things to students. This teachers' profile is accordance with the general affective goals set by them. According to Karnezou et al. (2013), there are close links between teachers' beliefs and their practices during the visit and more specifically they found that teachers profiled in the "affective model" rely on the guide's presence and do not usually exploit the opportunities that the venue offers. On the other hand, FORTH seems to accept this situation of uninvolved teachers, something that widens the gap between the school knowledge and the knowledge offered at FORTH.

Another fact that reinforces the lack of learning orientation is the absence of post-visit activities. Only 18% of the teachers claimed that they will have a brief talk with the students when they get back in school. Research findings conflict as to whether teachers are aware of the importance of recommended practices, as for example post-visit activities (Dewitt & Storksdieck, 2008). A possible reason for that may lie in the fact that there is a lack of teacher training programs regarding their role in out-of-school learning contexts. According to Remmen and Iversen (2022), teachers should gain more knowledge about the use of outdoor education in the areas of physics chemistry, health education and geography.

Finally, the teachers themselves made some interesting suggestions for improving the school visit at FORTH, such as more hands-on activities or spending more time in each lab. These suggestions reinforce the importance of their role as they are aware of their students' needs but unfortunately the person in charge of school visits at FORTH is not informed in some way about these suggestions. At the same time people at FORTH believe that students are prepared prior the visit by their teachers, something that according to their teachers is not happening. So, there is a lack of communication between teachers and FORTH, which leads to their different perspectives. According to Melber and Abraham (2002), the better they communicate, the higher the educational benefits for both. So, these two parts, researchers, and teachers, should somehow be brought together in an educationally meaningful way.

Implications and Further Research

As research in the field of out-of-school learning expands, it becomes necessary to extend our knowledge to other non-formal settings, such as research centers. However, taking into consideration the diversity of informal learning environments, as well as the regional differences and the heterogeneity of these institutions, it is obvious that the generalization of the results is subject to certain restrictions. Instead, the growing number of studies on out-of-school learning can be used to provide a better foundation for expanding our knowledge and understanding of this type of institutions that could play a decisive role in the educational experiences of the students. This paper contributes to that effort with its research exploration focused on the teachers' and staff's perspectives regarding the school visits to the research center.

Research centers constitute an environment where on-going scientific research takes place, and their visitors can have direct access to cutting-edge scientific knowledge and practice. According to Berg et al. (2021), cutting-edge science motivates students to engage with science and out-of-school education could function as an alternative pathway to 21st century skills. The findings of this study indicate that the role of science teachers is crucial in order to have a learning orientation of the visit. Science teachers know their students, the class curriculum, and the conceptual background of the class (Anderson et al., 2000, Griffin & Symington, 1997; Henriksen & Jorde, 2001; Tal, 2004). On the other hand, the designer of the visit and the researchers of the institution understand their institutional needs, but they should also bear in mind the special needs and interests of the students. So, the blending of formal and informal learning seems to be a problematic situation.

As a consequence of the above, we suggest a collaboration between these two parts in order to jointly develop the school visit at FORTH. According to Henriksson (2018), teachers see cooperation with outside experts as something positive. At the same time, Piqueras and Achiam (2019) studied the collaboration between researchers and museum educators by introducing research-based frameworks in the work of museum educators and ended up in a successful collaboration. In our case, we suggest a deeper collaboration that could be implemented through a professional development program for science teachers provided by science education researchers that would focus on issues such as best practices or how they can maximize the effectiveness of school visits as learning experiences. Along with science education researchers, teachers will also collaborate with the researchers of the research center, so as to co-design the final structure of the visit. So, science teachers and researchers along with science education researchers could compose a community of learners (CoL). The aim of this CoL would be the design of a visit that could also include pre- and post-visit activities as well, so as to strengthen such boundary activities and to potentially create a more effective merging of in-school and out-of-school resources.

In conclusion, this study offers some understanding of teachers' and research center's relationships. Through a future collaboration between these two parts, we hope to deeper understand the relationships between science teachers and science researchers and to find the factors that influence the design of a school visit by bringing these two different sides together.

Disclosure Statement

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Appendix A

TEACHER INTERVIEW QUESTIONS

Preparation of the visit

1a. Why did you choose to visit FORTH?

1b. What are your expectations of the visit?

1. Was it possible to prepare your students for this visit? Explain how.

Perception of the visit

1. How the content of the visit relates to what the students had recently been taught?
2. How would you rate today's visit on a scale of 1 to 5 (5 representing the most valuable)?
3. What did you like most about the visit?
4. What did you like least about the visit?
5. What could it be different so as the visit to be more relevant to your students?

Post-visit

8. Do you plan to follow up this visit with class activities once you return to school? If so, what kind of activities?

Appendix B

INTERVIEW QUESTIONS

1. How did you choose the activities?
2. What are the goals of the school visits?
3. Do you believe that these goals are achieved by the students?
4. How is scientific knowledge transformed to school knowledge during the visit?
5. Do you believe that students face any difficulties during their school visit at FORTH?
6. Do you take into account the special characteristics of the students, such as their age, previous knowledge, alternative ideas etc., when you design the activities for the students?