



Research paper

The structure of teachers' beliefs when they plan to visit a museum with their class

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H I G H L I G H T S

- The structure of teachers' beliefs for museum visits are three-dimensional.
- The cognitive, affective, and cultivation of positive attitudes towards museums dimensions structure teachers' beliefs.
- The same structure underlies both pre- and in-service teachers' beliefs.
- A museum teaching experience changes the importance teachers' attribute to each of the three dimensions.
- Museum education courses should follow a holistic approach addressing the three dimensions simultaneously.

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This study explores the structure of teachers' beliefs regarding the planning of a museum visit with their class. We developed and administered the "Visit a Museum" (ViMu) questionnaire to 754 pre- and in-service Greek school teachers to examine teachers' beliefs based on three dimensions: the cognitive, the affective, and the cultivation of positive attitudes towards museums. Confirmatory factor analysis showed that teachers' beliefs are structured across the three uncorrelated dimensions tapping into the same factor that expresses their unity. This structure underlies teachers' beliefs regardless of whether they are pre- or in-service. Implications for teachers' education and professional learning are discussed.

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1. Introduction

Field trips are out-of-school excursions that teachers plan and implement for their class to settings such as museums, science centers, zoos, botanical gardens, aquariums, and archaeological sites. They are the most common out-of-classroom learning experience offered to students (Kisiel, 2006), and museums are the most popular destinations.

A key ingredient for a successful educational out-of-classroom experience is the teacher's involvement in all aspects of the museum visit (NRC, 2009). A plethora of research evidence has shown that innovative practices implemented by teachers are

strongly influenced by their beliefs (Fives & Buehl, 2008). That is why for over three decades, teachers' beliefs have been considered as the most critical psychological construct in their education (Pajares, 1992). Notably, teachers' education takes into consideration how these beliefs are related to practices. More recently, scholars have been investigating these beliefs from the point of view of conceptual change (Glogger-Frey et al., 2018; Vosniadou et al., 2020). Concepts, such as fragmentation and coherence, drawn from the debates in the conceptual change literature have been applied to examine and identify teachers' belief systems. With research having moved away from emphasis on unitary beliefs and their influence on teachers' practices, new insights have been gained in better understanding the actual structure of these belief systems. Previous studies showed that pre-service teachers might have fragmented beliefs (i.e., do not constitute a framework) on one particular topic (e.g., their beliefs regarding learning strategies; Glogger-Frey et al., 2018), and more coherent beliefs on another

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topic (e.g., the self-regulation of learning; Vosniadou et al., 2020).

Vosniadou et al. (2020) state that “uncovering the relationships among beliefs is important in order to understand teachers’ practices and to guide interventions” (p. 3). Understanding how teachers’ beliefs are structured regarding a class visit to a museum is conducive to designing the most appropriate and effective methods for teacher education, including their professional development. Teachers with fragmented and isolated beliefs about school museum visits need intervention programs that will assist them in constructing a more coherent viewpoint, which is in accordance with the most recent scientific evidence on the subject (Ohst et al., 2015; Orrill & Eriksen Brown, 2012). On the other hand, those teachers who have a coherent, well-organized belief system which, however, deviates from the current scientific framework should become aware of the presuppositions that constitute their framework of their beliefs. Explicit discussion along with clear reflection will help them to perceive that an acceptable scientific framework has higher explanatory power than their existing belief system, and that their students will benefit more, if as teachers they adopt it (Lawson et al., 2019).

Although teacher educators are aware of the importance of teachers’ beliefs on their teaching practices, little has been done so far to examine the structure of these belief systems in general, and more specifically on school visits to museums. In the present study, instead of examining how teachers’ beliefs regarding a class museum visit affect their practices, we were more interested in pursuing how these beliefs are actually structured and how they relate to each other. Thus, the study contributes to providing evidence, which can be applied as the basis for the development of intervention programs in teacher education and professional development.

2. The importance of school visits to museums

The importance of school visits to museums has been well documented over the years. The three main reasons why such visits should be encouraged are: 1) museums have a great impact on new knowledge acquisition, learning experiences, and outcomes (Andre et al., 2017; DeWitt & Storksdiack, 2008; Kisiel, 2005); 2) they offer an excellent opportunity for pupils to learn outside a traditional classroom environment while having fun, as well as giving them a break from the daily school routine (Kisiel, 2005; Storksdiack et al., 2006); and 3) they familiarize children with museums as an institution, cultivating thus, a positive attitude towards such sites (Anderson et al., 2006). Although the positive affective experience may contribute to attitude change towards museums (Falk et al., 2004; Kindler & Darras, 1997; Piscitelli & Anderson, 2001), the concept of attitude as a psychological construct is much broader, being comprised of behavioural and cognitive components (Breckler, 1984). In a nutshell, besides alternative ways of learning, enjoyment and time-out from school, one of the most significant motives for teachers should be to cultivate an appreciation of museums in their students (Karnezou, 2010).

3. Teachers’ beliefs about a class visit to a museum

The findings of a qualitative study (Karnezou et al., 2013) on teachers’ evaluation of a Science and Technology Museum visit showed that importance was placed on two factors, namely, the learning outcomes (cognitive factor) and the positive emotions and experiences that they gained from the visit (affective factor). Although, perhaps, this was not surprising, it was useful to establish empirically. The case that teachers emphasized either the cognitive or the affective dimension appeared to be consistent with their aims, preparation, and practices before, during and after the

excursion. This also included what they perceived their role to be during the visit, as well as what outcomes they expected from the field-trip. In sum, the study put forward an explanatory framework linking teachers’ practices with their beliefs regarding the value they attribute to museum visits. Although studies have focused on various aspects of a class visit to a museum, such as the teachers’ goals (Anderson & Zhang, 2003), their educational and mediating role in various steps of the visit (Faria & Chagas, 2012; Tal et al., 2005), the outcomes from the visit (Anderson et al., 2006), or the follow-up activities teachers organize back at school (Behrendt & Franklin, 2014), the actual structure of those beliefs, has not been examined in any of these studies.

To the best of our knowledge, there are no studies to date that have investigated whether teachers’ beliefs regarding museum class visits are structured, thus, representing a coherent explanatory framework, or whether they are fragmented. To be able to answer this question, it is necessary to provide evidence on whether teachers’ beliefs are embedded in a coherent overarching system that is either employed in context and situations independently (Vosniadou et al., 2020), or is context-dependent (Glogger-Frey et al., 2018). If teachers hold a fragmented network of beliefs about museum visits, these should be context-specific, that is, the intercorrelation of beliefs in each phase of the cycle of the museum visit should be higher than the intercorrelation of the beliefs representing each dimension; namely the cognitive, the affective, and the cultivation of positive attitudes towards museums. If teachers have a coherent system of beliefs regarding a museum visit, this should then underly the entire cycle of the visit: their aims and objectives, their preparation, their practices before, during, and after, their role during, and the expected outcomes of that visit.

4. The goals of a school visit to a museum

A school visit to a museum could serve a whole host of different aims and objectives. From these the teacher decides which goals to set according to the curriculum, and based on the needs of their class at that particular time. Simultaneously, the prioritization of the set goals influences the overall outcome of the visit. A number of studies indicate that there are two main goals that teachers consider when they organize a class visit to a museum. The first is related to the cognitive dimension, aiming to extend learning opportunities for their students and improve learning outcomes related to the curricula (Anderson & Zhang, 2003; Kisiel, 2005; Storksdiack et al., 2007). Teachers most often justify museum visits in terms of curriculum fit (Kisiel, 2005; Olson et al., 2001; Rudmann, 1994; Storksdiack et al., 2007). When they justify them on tentative positive learning outcomes, they connect the visits to specific curriculum topics, develop specific activities to explore selected concepts, and ask their students to check how different aspects of the exhibition relate to the curriculum (Kisiel, 2005). Put differently, teachers perceive museum visits as a learning resource from which all students, irrespective of their school performance, cultural or social background, can derive meaningful learning outcomes (Hooper Greenhill, 2004).

The second goal of a school museum visit is associated to the affective dimension (Rudmann, 1994). This refers to the enjoyment students would potentially experience during the visit (Anderson & Zhang, 2003), establishing learning motivation (Anderson et al., 2006; Karnezou, 2010; Loukomies et al., 2013), and getting away from the class routine (Karnezou, 2010). There is evidence suggesting that teachers consider a change in pupils’ attitude towards museum visits to be one of the affective goals, which is achieved by enhancing their perceived value of the museum experience (Anderson & Zhang, 2003). The two dimensions – cognitive and affective – are not necessarily mutually exclusive, and many

teachers tend to see them as complementary, setting both types of goals in the museum visit activities (Anderson et al., 2006).

5. Teachers' preparation for a school museum visit

Preparing the class before visiting a museum is essential to ensuring a successful field-trip (Anderson et al., 2006), which, to a great extent, depends on the teacher's knowledge of the venue (Anderson et al., 2006), content, and layout of the particular museum (Behrendt & Franklin, 2014). Following this, they should prepare their class with well-planned activities that support the learning dimension of the visit (Morentin & Guisasola, 2014). It appears, however, that the majority of teachers do not invest time in preparing their students prior to the trip (Griffin, 2004; Karnezou, 2004), and tend to typically limit themselves to practical issues, such as the timeline for the visit and class management (Griffin & Symington, 1997; Tal et al., 2005).

The findings of a study on how teachers prepared themselves and their students for a museum visit showed that teachers' views on informal education and the outcomes they expected of such a field trip formed the basis of their preparation (Karnezou et al., 2013). In particular, two patterns that associated teachers' views and practices were identified. When teachers primarily set cognitive goals, in conjunction with fewer affective goals, they did preparation both for themselves and their class. In contrast, when they set primarily, or solely, affective goals, preparation either for themselves or the students ranged from limited to non-existent. However, very little is known about how teachers prepare or which goals they set, in regards to cultivating a positive attitude in their students towards a museum visit. Therefore, any effort to define how teachers prepare their class when their priority is to change students' attitudes towards museums will be speculative. Since this goal is usually categorized as affective, we can reasonably assume that it does not involve much if any preparation on the teacher's part.

6. Activities before, during, and after the museum visit

Some researchers maintain that while field trips need to provide a reasonable amount of structure to guide student learning, there should be ample space for free exploration on the part of students; this not only enhances their museum experience but empowers them in gaining knowledge (Bamberger & Tal, 2008; DeWitt & Storksdiack, 2008; Gutwill & Allen, 2012). Evidence suggests that teachers' practices are usually confined to explaining an exhibit, asking on-the-spot questions to elicit responses, as well as encouraging pupils to explore, read labels, and take photos (DeWitt & Storksdiack, 2008; Griffin & Symington, 1997; Kisiel, 2006). Nevertheless, it appears that often there is a lack of organized activities that link the visit to specific cognitive or even affective goals, suggesting that teachers may either be unfamiliar with the field trip setting (Rebar, 2012; Tal et al., 2005), or unaware as to how museum learning works (Kisiel, 2003). Studies have revealed that the reasons which teachers give in their defence as to why they do not spend time on pre- and/or post-visit activities include matters such as: curriculum constraints, management requirements, and safety concerns (Anderson et al., 2006; DeWitt & Storksdiack, 2008; Tsaliki et al., 2015).

There is a strong body of research highlighting the importance for teachers to offer their students a meaningful museum experience through the combination of designing preparation, visit, and follow-up activities (Bamberger & Tal, 2008; DeWitt & Storksdiack, 2008; Gutwill & Allen, 2012). In a study on art museum visits, the findings showed that their success depends on the relevance between visit and classroom subject matter taught, the teacher's

initiatives, curriculum requirements, and teaching context (Xanthoudaki, 1998). In regards to practices, it seems that teachers who set affective goals tend not to prepare their pupils beforehand, and refrain from giving students any organized activities while at the museum, however, they are likely to give them post-visit follow-ups, as they are more interested in their pupils' impressions. On the other hand, teachers who focus on cognitive goals, prepare their class for the intended visit, and mediate their pupils' experiences in the museum with the intention of assisting them to contribute to their own cognitive gains (Karnezou et al., 2013).

Although, evidence indicates that teachers rarely integrate field trip experiences into the curriculum (Griffin, 2004), or assess the outcomes after a visit (Anderson et al., 2006), those who set cognitive goals, mediate their pupils' experiences in an attempt to link them to school knowledge, or they may conduct an experiment based on an interactive exhibit they saw at the museum (Karnezou et al., 2013). However, it is not known whether teachers who view these visits as an opportunity to create positive attitudes towards museums, develop any specific activities before, during, or after the event, nor is it easy to surmise which particular activities they would choose to implement at any stage.

7. The teacher's role during the visit

Museum education has adopted a sociocultural perspective, placing emphasis on students and their active involvement in the learning processes, with a particular focus on social interaction (Falk & Dierking, 2000). From this perspective, teachers who take their class to a museum must take on a particular role, prior to, during, and after the visit, thereby, offering their students a meaningful learning experience (Hein, 1998). In their study, DeWitt and Storksdiack (2008) gave recommendations for teachers to maximize the effectiveness of school visits as learning experiences. These include: familiarization with the setting before the trip, students' orientation to the setting, clarification of the visit agenda and the learning objectives, pre-visit activities aligned with curriculum goals, provision of time for pupils to explore and discover during the visit, activities that support the curriculum and fit with the unique characteristics of the setting, and, finally, post-visit activities to reinforce the field trip experience.

Although the role of the teacher has been shown to be interconnected to the impact that a museum visit has, (Behrendt & Franklin, 2014), it appears that practices which facilitate pupils' learning are hardly ever adopted (Anderson et al., 2006; Griffin & Symington, 1997). Teachers tend to deal mainly with class management, while their role during the visit is often poorly defined. Several studies point to the uncertainty teachers experience in regards to their role, as well as the fact that some teachers are unaware of the role that they can undertake during a field trip (Kisiel, 2005; Tal et al., 2005). The consequence of this is that teachers do not integrate field-trips into the curriculum or choose activities with a socio-cultural context, which is enhanced by implementing learner-centered, inquiry-based approaches (Cox-Petersen et al., 2003; Griffin, 2004).

Furthermore, it has been shown that even when teachers are aware of field trip practices, they may ignore them due to time constraints, resulting from an overcrowded curriculum and logistical issues at school, or they may adapt them in whichever way they see fit (DeWitt & Storksdiack, 2008). Teachers adopt an active role regarding the museum visit when they set mainly cognitive goals and few affective ones. Teachers' active role is evident in their preparation of their class before the visit, the support of interactions with the artefacts and their classmates in the museum, and the organization of related activities back at school (Karnezou et al., 2013). In contrast, when a teacher sets only affective goals,

their role is less distinctive, tending to merely announce the visit to the class, letting the guide take over during the stay, and at most, may set up a discussion back at school (Karnezou et al., 2013). However, it is not known— and forming any assumptions in this regard would be mere speculation - how teachers who see a visit to such a place as a chance to instill positive attitudes in their students regarding museums actually view their role.

8. School visits to museums: outcomes

Research on out-of-school contexts provides evidence that school trips can result in both cognitive and affective gains for students (Bamberger & Tal, 2008; Bell et al., 2009), which, however, should not be assumed as being the case (Behrendt & Franklin, 2014).

Through the years, the learning outcomes of field trips have been broadened beyond facts and concepts to include the acquisition of skills, and the development of critical thinking (DeWitt & Storksdiack, 2008). Learning during a field trip is no longer seen as merely an extension of classroom teaching, but as a valuable supplement to this type of instruction, and an excellent way to prepare students for future learning (Hofstein & Rosenfeld, 1996; Storksdiack et al., 2007). A series of critical factors that fundamentally influence the learning outcomes of a field trip include: students' prior knowledge and interests, students' experiences during the visit, pre- and post-visit activities, orientation to the learning environment, the social context of the visit, teachers' beliefs about curriculum fit, and obstacles to field trip planning (Anderson et al., 2006; DeWitt & Storksdiack, 2008; Griffin, 2004).

In regards to museum visits, it is now better understood and widely accepted that cognitive knowledge, (i.e., the processes of learning and the acquisition of facts and information), cannot be disassociated from affective knowledge, (i.e., one's feelings, actions, values, or location) (Hooper Greenhill, 2004; Pnevmatikos et al., 2019). Hence, learning outcomes may have any combination of cognitive, affective, behavioral or social aspects (Rennie & Johnston, 2004), which are intertwined in a variety of ways. For example, a student's interest in science is influenced by their understanding of the subject and their development of scientific skills (Stocklmayer et al., 2010). It has been suggested that affective outcomes - such as increased motivation or interest, sparking curiosity, or improved attitudes towards a topic - may be more feasible goals for school trips than specific factual or concept learning outcomes, since the short-term nature of field trip experiences may not be conducive to lasting cognitive effects (DeWitt & Storksdiack, 2008). The importance of the emotional and social context on the learning outcomes of a visit have likewise been emphasized (Ballantyne et al., 2011).

Attitudes developed during field trips can have long-lasting impacts on how one perceives institutions, such as museums (Hooper Greenhill, 2004). So, when a student develops a positive attitude during a class visit to a museum, it constitutes an affective outcome. Findings suggest that positive experiences of museums during childhood develop a life-long interest in museum visits (Falk et al., 2004; Kindler & Darras, 1997; Piscitelli & Anderson, 2001). However, since attitudes are learned over time, we cannot expect that students might experience significant attitude change after one or even a few such field trips (Rennie, 1994).

9. The current study

Researchers in museum education have defined three reasons to justify school visits to such places: new learning experiences, the likelihood of having fun, and the cultivation of positive attitudes towards museums. Likewise, there is indication that teachers consider at least three dimensions when planning a museum visit,

namely the cognitive, the affective, and cultivating of positive attitudes towards museums. Studies have shown that teachers' practices might differ in at least five phases of the museum-visit cycle: (a) the overarching goals of the visit, (b) teacher's preparation, (c) the activities before, during and after the visit, (d) the teacher's role, and (e) the expected outcomes of the visit. However, we do not know whether the three dimensions, (cognitive, affective, and cultivation of positive attitudes towards museums) serve as latent factors in guiding teachers' expectations and beliefs in their overall planning and involvement in this out of school activity. Knowledge of this kind will help us to understand the nature of teachers' beliefs (i.e., whether they constitute a coherent framework or are fragmented), and develop suitable interventions in teacher education and professional development. The aim of the present study was to shed light on this issue.

Based on cues from previous studies, we formulated two alternative primary hypotheses: teachers' beliefs (a) constitute a coherent explanatory framework that is structured across the three dimensions: cognitive, affective, and the cultivation of positive attitudes towards museums (Hypothesis 1), and (b) teachers' beliefs are inconsistent (Hypothesis 2). If the first alternative hypothesis is correct, then the three dimensions would serve as latent factors affecting the five phases of the museum-visit cycle consistently. If the second alternative hypothesis is correct, then, one might expect that the practices teachers choose for a hypothetical future visit to a museum would comprise either one dimension or be fragmented and could not be explained by the three latent factors. Should the first hypothesis be confirmed, the question that arises is what the relationship between the three dimensions is. Are these three dimensions correlated and how? Although the answer to this question is important and has implications for teachers' education, the lack of sufficient prior evidence does not allow us to formulate a safe hypothesis. Hence, three alternative hypotheses will be tested: the three dimensions are correlated (Hypothesis 3a), uncorrelated (Hypothesis 3b), and they tap into the same underlying construct, namely they are explained by a second-order factor indicating that teachers' beliefs for museum visits should be considered unitary, having at least three completely independent orthogonal constructs (Hypothesis 3c). Additionally, the necessity of three subscales will be tested with a simple structure model.

Finally, the study also aimed to examine whether the same model could explain the structure of the beliefs in different groups of teachers, namely pre- and in-service teachers. Furthermore, we were also interested in seeing whether there were any individual differences between pre- and in-service teachers, among teachers working in different levels of education (early childhood education teachers, general primary school teachers, and secondary specialized subject-matter teachers), as well as potential gender differentiation.

10. Method

10.1. Participants

This study comprised of seven hundred and fifty-four (754) participants, specifically, pre-service ($n = 348$, 46.2%) and in-service ($n = 406$, 53.8%) teachers. Participants were a convenience sample, consisting of University students and teachers from in-service training courses both at the Faculty of Education of the University of Western Macedonia, Greece. Pre-service teachers had no experience of organizing a visit to a museum, while the majority (84%) of the in-service teachers had visited a museum with their class at least once. Table 1 presents the characteristics of the study participants

Table 1
Participants' characteristics.

Features	Subcategories			
Gender	Female 79.2%	Male 20.8%		
Teaching experience	Pre-service 46.2%	In-service 53.8%		
Age	≤30 49.3% mainly pre-service	30–40 12.6%	40–50 32.4%	>60 5.7%
Education level	Nursery 40.7%	Primary 47.9%	Junior and junior high 11.4%	

Table 2
Structural Equation Models examined for the structure of teachers' beliefs about museums visits with their class.

Model	S–B χ^2	df	sig	CFI	RMSEA	90% CI
Model 1	226.52	90	<.001	.846	.48	.040–.055
Model 2	197.33	87	<.001	.876	.044	.036–.052
Model 3	37.68	86	1.00	1.00	.000	–
Model 3a	83.02	86	.057	1.00	.000	.000–.029
Model 3b	83.02	86	.048	.950	.027	.003–.042
Model 3c	21.16	86	1.00	1.00	.000	.000–.000
Model 3d	23.16	86	1.00	1.00	.000	.000–.000
Model 4	617.14	90	<.001	.406	.94	.087–.101

10.2. Measurements

The “Visit a Museum” (ViMu) questionnaire was developed to explore teachers' beliefs about museum visits with their class. A rubric of the three dimensions (cognitive, affective, attitude towards museums) with five items for each dimension, representing the five phases of the museum visit, were used to construct the ViMu questionnaire (15 items in total). The first two columns present teachers' beliefs for the cognitive and affective dimensions, respectively, of a museum visit and the school curricula. Specifically, the five items of each of these two columns refer to the museum visit in terms of: (a) the aim/scope, (b) teachers' preparation, (c) the activities before, during, and after, (d) the expected outcomes, and (e) the role of the teacher (Karnezou et al., 2013). For example, the item that refers to the aim/scope of the visit for the cognitive dimension was “School visits to museums should always be linked to curriculum objectives”, while for the affective dimension, it was “The interesting part of a school visit to a museum is to enjoy the visit itself and not the learning impact for pupils”. The third column presents teachers' beliefs about cultivating students' positive attitude towards museums. For this column, the items refer to the goal and the outcomes of the visit, as there is lack of relevant evidence on the preparation or the activities that teachers might organize before, during, and after the visit that might be different from the affective dimension. Participants rated their opinions of the statements on a 4-point Likert type scale (1 = I fully disagree to 4 = I fully agree).

11. Results

To examine the pattern of the inter-correlations of the beliefs teachers have when they are planning a museum visit, Exploratory Factor Analysis (EFA) with oblim in rotation was applied to the data. The Kaiser-Meyer Olkin measure of sampling adequacy suggested that the sample was factorable (KMO = 0.72). The analysis revealed three factors with eigen values greater than 1.00 explaining 26.9% of the total variance. The three factors have a conceptual meaning as they loaded the items from the three columns of the rubric, namely the attitudes towards museums (11.96%), the cognitive (9.20%), and the affective (5.76%) dimensions of teachers' beliefs.

That is, EFA analysis did not confirm our alternative hypotheses that teachers' beliefs about a museum visit are one-dimensional or fragmented.

To further verify the structure of the Questionnaire and the relationship between the three factors, Confirmatory Factor Analysis (CFA) using EQSWIN software (Bentler & Wu, 2003) was performed. Given multivariate non-normality (normalized estimate of Mardia's multivariate kurtosis greater than 5.0), the ML robust method of estimation was employed (Byrne, 2006). Thus, the robust estimates, such as Satorra and Bentler (S–B) chi-square, CFI, RMSEA, and its 90% Confidence Interval (CI) were used (Table 2).

The model with three first-order unrelated factors that were regressed to the items of each factor was tested (Model 1). The analysis showed that the model had a weak fit to the data. Then, the model assuming a correlation between the three factors was tested (Model 2). This model had a better fit, but it was still non-acceptable. The weak fit of this model (Model 2) indicates that the three constructs are not correlated; changes in one does not result in proportional changes in the others. Then, a second-order factor was added to the model to obtain more generalized teachers' beliefs about museum visits (Model 3). This model was found to have an excellent fit. The second-order factor shows that the three factors essentially tap the same underlying construct. Hence, they should be considered unitary, expressing how the teachers think when planning a school visit to a museum. Moreover, this model had an excellent fit for both pre-service (Model 3a) and in-service teachers (Model 3b), as well as for both those with experience (Model 3c) and those without any experience in organizing museum visits (Model 3d). Lastly, the simple model, where all the items were regressed into one factor, was tested (Model 4). The model had a weak fit to the data, indicating the necessity of the three first order constructs to the model, when studying teachers' beliefs about museum visits. In other words, the CFAs confirmed that the same structure underlies teachers' beliefs regardless of whether they are pre- or in-service, have or do not have any experience in organizing visits to museums.

Finally, as the three constructs are orthogonal, exploratory Principal Component Analysis (PCA) with varimax rotation was applied to the data. The analysis revealed three components with eigen values greater than 1.00, explaining 41.02% of the total variance, which were identical with the structure described above. Table 3 presents the loadings of the PCA analysis. The three latent factors that guide what teachers think of a museum visit with their class, are similar to the reasons that researchers have identified as important, and they are not one-dimensional or fragmented and situation-specific.

The analyses so far showed that teachers' beliefs about school visits to museums are structured and, hence, constitute a coherent framework of beliefs which are in agreement with other researchers. The same coherent framework explains the beliefs of teachers regardless of whether they are pre-service or in-service they have experience in organizing museum visits, or whether they are working in different levels of education. However, the

Table 3
Loadings from the principal component analysis.

Items	Component		
	1	2	3
Before a school visit to a museum, a teacher should check how/if the exhibits are linked to the school subjects he/she teaches.	.691		
What one anticipates from a school visit to a museum is pupils to be helped to attain the learning goals of the related school lesson.	.657		
During a school visit to a museum, I help my pupils connect our school lesson to what they see in the museum.	.650		
During the visit, the museum guides should link the guided tour to school lessons.	.649		
School visits to museums should always be linked to curriculum objectives.	.532		
What one anticipates from a school visit to a museum is that pupils develop a positive attitude towards the museum content.		.745	
A school visit to a museum is important because pupils will love the museum content.		.739	
The objective of a school visit to a museum is to raise pupils' interest in learning.		.629	
During a school visit to a museum, guides' only goal should be that pupils become keen on the museum.		.528	
It is important to visit a museum, even if it is only for the pupils to have such an experience.		.421	
Before a school visit to a museum, a teacher should explain to his/her pupils the great time they will have.			.635
During a school visit to a museum, pupils should simply enjoy their time with the exhibits.			.632
After a school visit to a museum, asking pupils to write a composition about the visit is the only thing a teacher should do.			.589
What one anticipates from a school visit to a museum is that pupils have a break from the daily school routine.			.561
The interesting part of a school visit to a museum is the visit itself and not the learning impact for pupils.			.523
Explained variance (41.02%)	14.81%	13.56%	12.68%

identical structure does not mean that the three constructs have the same value among the different groups. Following, mixed design, repeated measures ANOVAs were conducted with the means of the three factors as the within-participants factor, and work experience (pre-vs. in-service) and gender as the between-participants factor. This was in order to examine whether work experience and gender, differentiated teachers' beliefs regarding school museum visits. The analysis revealed that the within-participants factor main effect, $F_{(2,1498)} = 343.05, p < .001, MSE = 51.93, \eta_p^2 = 0.314$ was statistically significant. Post-hoc comparisons using Bonferroni correction showed that, overall, teachers endorsed the dimension of the positive attitude for museums ($M = 2.83, SD = 0.43$) significantly more ($p < .01$), when organizing a visit, than the cognitive dimension ($M = 2.74, SD = 0.39$), and significantly more ($p < .001$) than the affective dimension ($M = 2.14, SD = 0.39$). Moreover, they considered the cognitive dimension ($M = 2.74, SD = 0.39$) as significantly more important ($p < .001$) than the affective ($M = 2.14, SD = 0.39$) one. Additionally, a significant interaction with participants' work experience was obtained, $F_{(2, 1498)} = 20.05, p < .001, MSE = 3.03, \eta_p^2 = 0.026$. Follow up One-Way ANOVAs showed that pre-service teachers ($M = 2.80, SD = 0.43$) endorsed the cognitive dimensions more than in-service teachers, $F_{(1,752)} = 2.06, MSE = 2.06, p = .001$. On the other hand, in-service teachers ($M = 2.93, SD = 0.40$) endorsed ($M = 2.93, SD = 0.40$) the cultivation of a positive attitude towards museums as being significantly more important than pre-service teachers, $F_{(1,752)} = 47.43, MSE = 8.02, p = .001$. However, work experience did not seem to affect the endorsement of the affective dimension, $F_{(1,752)} = 3.29, MSE = 0.52, p > .05$. Finally, there was no significant interaction regarding gender.

To examine whether early childhood education teachers, general primary school teachers, and secondary specialized subject matter teachers held different views when thinking to plan a museum visit, a series of three one-way ANOVAs were conducted. The analysis showed that all three groups endorsed the affective dimension, and the creation of a positive attitude towards museums dimension to the same extent, $F_s < 2.04$ and $p_s > .14$. However, their endorsements significantly differed when they considered the cognitive dimensions for visiting a museum, $F_{(1,752)} = 10.127, MSE = 1.99, p < .001$. Tukey posthoc comparisons showed that the specific subject matter teachers ($M = 2.52, SD = 0.49$) endorsed ($p_s < .003$) the cognitive dimensions less than the early childhood education teachers ($M = 2.8, SD = 0.46$), and

the general primary school teachers ($M = 2.73, SD = 0.42$), while there was no significant difference between the early childhood education and primary school teachers ($p > .05$).

12. Discussion

It can be rather difficult to differentiate between a person's beliefs and their knowledge (Ohlsson, 2009). However, it is important to be aware of teachers' beliefs because then their decisions as regards teaching can be better predicted (Pajares, 1992). What's more, recent findings indicate that teachers' beliefs (but not their knowledge) are a crucial factor in promoting changes in teaching practices (Dignath-van Ewijk & van der Werf, 2012). Newer research has shifted from the association between teachers' beliefs and teaching practices to the actual nature of these beliefs, i.e., their structure (Glogger-Frey et al., 2018; Vosniadou et al., 2020). Adopting the terms of the conceptual change approach, researchers questioned whether the beliefs teachers hold on various aspects of everyday practice, were coherent or fragmented. The current study addresses, for the first time, the structure of teachers' beliefs regarding school visits to museums, which is a relatively new educational practice in Greece.

13. The structure of teachers' beliefs for school visits to museums

The study findings showed that teachers' beliefs about museum visits were neither fragmented nor one-dimensional (Hypothesis 2). Instead, there were three latent factors, which seem to guide their decisions, at least as far as the scope of the museum visit is concerned, their preparation, the activities they would plan before, during and after, their expected outcomes, and their role (Hypothesis 1). More specifically, teachers' beliefs about museum visits constitute a coherent framework and are structured across at least three dimensions: the cognitive, the affective, and the cultivation of positive attitudes towards museums. These dimensions reflect the three main reasons why one would organize a class visit to a museum: positive impact on new knowledge acquisition, learning experiences, and outcomes (Andre et al., 2017; DeWitt & Storksdiack, 2008; Kisiel, 2005); the opportunity for pupils to have fun and a change from the school routine (Kisiel, 2005; Storksdiack et al., 2006); and the familiarization with the museum as an institution, while at the same time, cultivating a positive attitude towards such sites. These reasons have been addressed by

researchers in the field of museum education, who have stressed the benefits of such visits for schools (Anderson et al., 2006; Andre et al., 2017; DeWitt & Storksdiack, 2008; Kisiel, 2005; Storksdiack et al., 2006).

Our study findings also showed how these three dimensions relate to each other. The examination of alternative models testing the relationship between the three dimensions showed that neither the model allowing the three dimensions to be correlated (Hypothesis 3a), nor the model that did not allow any correlation (Hypothesis 3b) between the three dimensions had an unacceptable fit to the data. However, the insertion of a second-order unifying factor to the three-factor model yielded an excellent fit. In other words, teachers' beliefs are structured on three dimensions, which are neither correlated nor entirely independent, but they do tap into the same belief system, when a visit to a museum is planned. Model 3, which had an excellent fit for pre- and in-service teachers (both those with and without experience in museum visits), indicates that the structure of these beliefs remains robust and does not change with teaching experience, nor with experience in organizing museum visits. We would expect that this structure underlies teachers' beliefs in other informal educational settings as well. However, this needs to be confirmed with further research.

This structure that teachers' beliefs are based on does not mean that the three dimensions have equal weight, nor does it preclude individual or group differences. In the present study, the order in which the majority of participants endorsed the statements were as follows: the highest support was expressed overall for the dimension on cultivating a positive attitude towards museums, which was followed by the cognitive, and lastly, the affective dimension. What this means is that when Greek early childhood, primary and secondary school teachers (both male and female) plan a museum visit, they set as their overarching goal to familiarize students with the specific environment and, in this way, encouraging what could prove to be a life-long lasting positive attitude towards museums. The connection of the visit with the curricula is not their focus point of interest.

Regarding the two groups, our findings showed that pre-service teachers tended to rate the statements on the cognitive dimension as more important than the in-service teachers, which confirms the results of the study by Kisiel (2013). In Greece, the specialized field of museum education, which enhances the role of non-formal education, has only recently been introduced in the teacher education curriculum, and it is rarely included in professional development training programs. However, our findings showed that early childhood education and primary school teachers who had had an introduction to museum education during their undergraduate studies tended to associate the visit to curricula learning more often than secondary subject matter teachers who had no such education. An interpretation for this could be that the education of teachers influences their beliefs regarding the importance of the connection between a museum visit and the curriculum. Hence, one would expect that teachers' beliefs in other informal educational settings might have the same structure, but they will differ regarding the intensity with which each dimension is endorsed. The intensity in the endorsement of each dimension reflects teachers' beliefs in the specific context and time. Finally, all teachers participating in the study, irrespective of experience or education, perceived the affective dimension as the least important of the three. This evidence needs further investigation in the future.

Overall, the structure of teachers' beliefs regarding school visits to museums constitutes a coherent system, and these beliefs are well-organized across the three dimensions examined here. Each dimension has its unique importance underlying teachers' decisions in planning a museum visit, and none of the three should be underestimated. Whichever dimension is prominent, influences

their decisions for the whole cycle of the visit, leading to the implementation of different teaching practices. The same structure explains the teachers' belief systems of all the groups examined here, and it is expected to be applicable in other educational settings. Nevertheless, fluctuations in the importance of each dimension among teachers are expected, which reflect their beliefs in both context and time.

Finally, we believe that the ViMu questionnaire could be exploited by teacher educators as a tool to identify the beliefs that particular teacher groups (pre- or in-service) hold. This knowledge would be beneficial in helping them to make well-targeted decisions about the emphasis of the courses, as well as to compare and enhance the effectiveness of their interventions.

14. Limitations and future directions

A limitation of the current research is that the investigation of the structure of teachers' beliefs is confined to teachers from one country. More research is needed to test the conceptual and construct validity of the questionnaire in other countries and different educational systems. Moreover, future research should examine further whether the three-dimensional belief system for museum visits can explain the practices teachers implement when they plan and perform a visit to a museum. In the current research, we studied the structure of teachers' beliefs irrespective of the type of museum. Future research should examine whether teachers' beliefs differ according to the type of the museum visited.

15. Implications for teacher education and professional development

Being aware of teachers' beliefs is considered a crucial factor in promoting changes in teaching practices, even more so than their knowledge (Dignath-van Ewijk & van der Werf, 2012). Thus, teacher education programs should take into account how to alter these beliefs when they deviate from the current scientific approach. Conceptual change research has shown the difficulties that individuals have when they come up against new scientific information, which requires them to revise their prior beliefs to a substantial extent (Vosniadou, 2013). The critical element to facilitate this review of one's beliefs is to understand their structure and the nature of the deviations from the current scientific approach. Knowing the structure of the beliefs, teachers' educators could decide for the appropriate teaching in their courses. is critical to deciding how to approach the teaching of a particular topic.

Since the teachers in the present study were found to have a coherent belief system, which incorporated the three main reasons for going on a museum visit that are stated by researchers in the field, they do not need to be facilitated to integrate their beliefs into such a framework (Ohst et al., 2015). They are aware that their decisions for the entire cycle of the museum visit are affected by their reasons for choosing to take their class to that particular environment. The three dimensions, which teachers' beliefs are based on, are independent. More specifically: (a) each dimension is critical, underlying teachers' decisions when they plan a museum visit, (b) the three dimensions are not mutually exclusive (i.e., teachers in favour of one dimension do not preclude the consideration of the other dimensions as also being meaningful), and (c) modifications in one dimension do not necessarily lead to similar effects in the other two dimensions. Teacher education programs should follow a holistic approach, and address the three dimensions separately, providing evidence as to why each one is important.

Researchers within the conceptual change paradigm suggest that when individuals have a coherent framework of beliefs that deviates from the scientific one, the teacher educator should

explain the greater strength and explanatory power of the scientific framework (Vosniadou et al., 2020). To conclude, teachers' education intervention on museum visits should focus on the importance of all three dimensions by providing evidence that the cognitive and affective dimensions offer just as many benefits as that which promotes positive attitudes for effective school visits to museums.

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