

Contextual expression of learning motivation in out-of-school learning environment: Comparing family and school visits to a natural wildlife park

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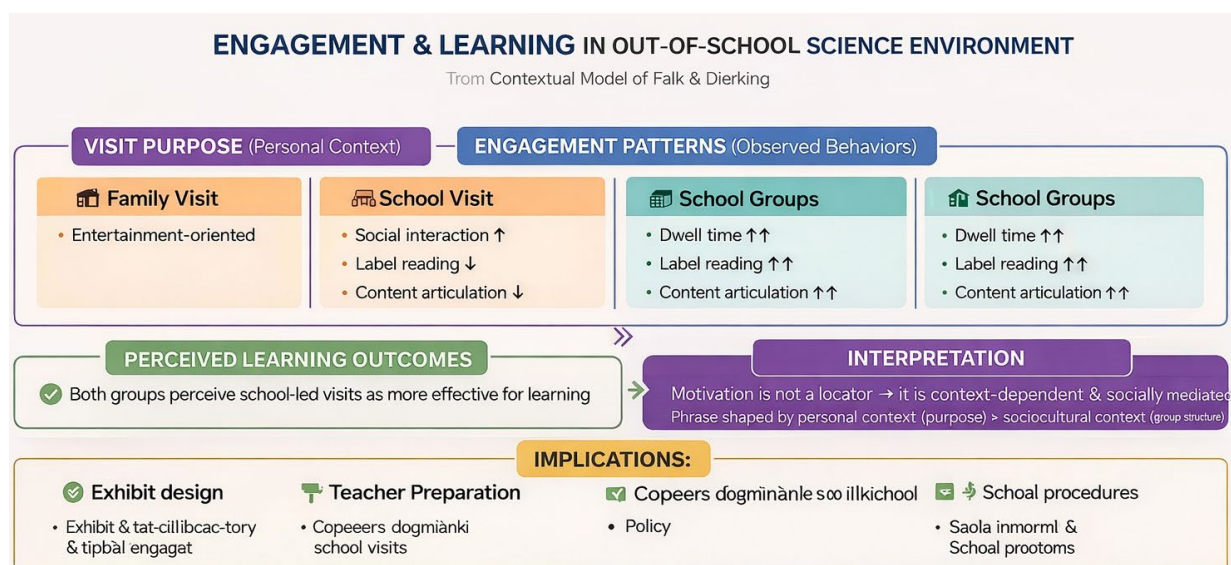
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Abstract: This study examines how visit purpose and visit configuration (family versus school groups) are associated with engagement patterns in an out-of-school science learning environment, specifically the Izmir Natural Wildlife Park. Drawing on Falk and Dierking's Contextual Model of Learning, learning motivation is conceptualized not as a latent psychological trait but as a contextually expressed process observable through engagement behaviors. A qualitative case study design was employed with 119 middle school students aged 11–14. Data were collected through semi-structured interviews and systematic observations, focusing on dwell time, label reading, interaction patterns, and reported learning outcomes. Findings indicate that visit purpose differed substantially between groups: family visitors predominantly reported entertainment-oriented goals, whereas school-group visitors emphasized learning-oriented purposes. These orientations corresponded to distinct engagement patterns. School groups demonstrated longer exhibit dwell times, higher rates of label reading, and more frequent articulation of specific content knowledge. In contrast, family groups engaged more socially within their own units but interacted less with interpretive materials. Despite these differences, children in both groups perceived school-led visits as more effective for learning. Interpreted within the contextual model framework, the findings suggest that visit purpose (personal context) and group structure (sociocultural context) shape how engagement becomes behaviorally visible within the same physical environment. Rather than indicating differences in intrinsic motivation, the results highlight how motivational activation is mediated by social configuration and institutional framing. The study contributes to the literature on science education in out-of-school learning environments by comparatively examining family and school visits within a wildlife park context and by operationalizing learning motivation through observable engagement indicators. Implications for exhibit design, teacher preparation, and out-of-school science learning environments policy are discussed.

Keywords: out-of-school science learning environments, learning motivation, family visits, school visits

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1 Introduction

1.1 Out-of-school science learning and the formal-non-formal-informal continuum

In this study, out-of-school science learning environment is used as an umbrella term for learning opportunities located outside the physical school classroom. Within this umbrella, teacher-led school visits are conceptualized as non-formal learning experiences because they occur outside school but are organized, curriculum-related, and pedagogically mediated. Family visits are conceptualized as more informal because they are voluntary, socially negotiated, and less institutionally structured. This distinction explains why both school groups and family groups fit the out-of-school context while representing different positions on the formal-non-formal-informal continuum.

Out-of-school science learning environments have become increasingly important complementary sites for science education because they allow learners to encounter scientific ideas through direct observation, social interaction, affective experience, and context-based meaning-making beyond the classroom. For science education research, the central issue is not only whether such environments support learning, but how different visit configurations make learning-related motivation visible through engagement behaviors.

Recent systematic and meta-analytic studies also indicate that zoos and aquariums function as productive formal, non-formal, and informal learning environments for children and adolescents, especially when visits include structured elements such as guided tours, keeper talks, staff interaction, or purposeful educational interventions (Baur, 2025; McNally et al., 2025; Schilbert & Scheersoi, 2023).

Out-of-school learning should be considered not as a single, uniform structure, but as a continuum situated between formal, non-formal, and informal ends. Non-formal

learning lies between formal and informal learning and often incorporates some structured elements related to the school curriculum within a more flexible and contextual framework (Affeldt et al., 2017; Stocklmayer et al., 2010; Tolppanen et al., 2015). In this context, non-formal learning takes place outside the traditional school curriculum, but it possesses certain organized and goal-oriented characteristics; learning progresses either through guided activities or through the learner's own initiative (Eshach, 2007; Stocklmayer et al., 2010). In the current study, teacher-led school visits show characteristics closer to non-formal learning, while visits involving family and more free daily interactions show characteristics closer to informal learning.

1.2 Contextual model of learning: personal, sociocultural, and physical contexts

Theoretical approaches in out-of-school science education emphasize that learning in such environments is not linear or predetermined, but emerges from the interaction between the individual and the context. According to Falk and Dierking's contextual model of learning (1997, 2004, 2013), learning experiences in out-of-school science learning environments are shaped by the dynamic interplay of three contexts: the personal context (prior knowledge, interests, and motivations), the sociocultural context (interactions with family, peers, or teachers), and the physical context (the design and characteristics of the environment). Therefore, any discussion of learning and motivation in out-of-school science learning environments must be understood within this contextual framework.

Within this framework, the current study treats visit purpose and prior familiarity as elements of the personal context; family members, peers, teachers, and institutional expectations as elements of the sociocultural context; and the wildlife park, animal shelters, interpretive signs, and educational facilities as elements of the physical context. This organization provides a direct theoretical basis for comparing family and school visits within the same setting.

From a contextual model perspective, visit purpose can be considered a component of the personal context that activates or shapes learning engagement. Different purposes may lead to different patterns of interaction, attention, and participation within the same physical environment.

Previous research has shown that field trips and visits to museums, zoos, aquariums, and other science-rich environments can support science learning when they are connected to clear purposes, social mediation, and opportunities for active interpretation (Griffin & Symington, 1997; Rennie & Johnston, 2004; Stocklmayer et al., 2010; Morag & Tal, 2012). Therefore, the present study avoids treating out-of-school learning as automatically effective and instead examines how engagement is shaped by purpose, social configuration, and the affordances of the physical setting.

1.3 Motivation and engagement in out-of-school contexts

In out-of-school learning environments, motivation is often expressed through behavioral engagement rather than measured as a stable internal trait. Visitors' questioning, interaction patterns, attention span, and participation in discussions can be interpreted as contextually activated expressions of learning motivation (Ash, 2004). Thus, motivation in this study is approached as an observable engagement process emerging within a specific context, rather than as a purely psychological variable. This behavioral interpretation is also supported by recent museum-based STEM research showing that students' metacognitive and motivational learning strategies predict engagement, perceived content relevance, and medium-term learning effects during school-related museum visits (Lewalter et al., 2025).

Recent micro-longitudinal evidence from a guided natural history museum visit further shows that state interest can change during the visit and is systematically related to learners' perceptions of the situation as intellectually demanding, pleasant, and social (Roemer et al., 2026). This supports a context-sensitive interpretation of motivational engagement rather than an assumption of a fixed trait.

Recent research further suggests that motivational processes in out-of-school settings are intertwined with situational interest, affective engagement, social interaction, and self-regulated learning. In zoological settings, emotional responses and curiosity may support science interest, while school-related museum research links motivational and metacognitive strategies with engagement and perceived content relevance (Photo, 2024; Photo & Shabalala, 2025; Lewalter Et Al., 2025; Roemer et al., 2026).

Visit purpose is particularly relevant to the personal context because visitors may arrive with different agendas, including socializing, spending time with family or peers, satisfying curiosity, seeking entertainment, or learning something new (Orion & Hofstein, 1994; Storksdieck, 2001; Tezcan Akmehmet & Ödekan, 2006; Türkmen, 2010, 2015; Yun, 2023). These purposes can shape what visitors attend to and how they interact with exhibits and other people.

1.4 Sociocultural configuration: family and school visits

1.4.1 Family Visits

Family learning in out-of-school settings is socially negotiated and often emerges through verbal and non-verbal interactions such as pointing, questioning, explaining, and connecting exhibits with prior experience (Diamond, 1986; Ash, 2004; Briseño-Garzón et al., 2007). Such interactions position family members as co-participants in meaning-making rather than as passive companions.

From a sociocultural context perspective, family visits may provide autonomy-supportive and collaborative interaction patterns that facilitate shared meaning-making. Such interactions may encourage more self-directed exploration and discussion, which

can be interpreted as indicators of motivational engagement. Recent family-learning studies further show that caregiver-child interaction, minimal guidance, facilitation, exhibit labels, and storytelling-based prompts can shape children's agency, conversation quality, and engagement with science-related objects (Franse et al., 2021; Letourneau et al., 2021; Manyukhina et al., 2024).

Recent museum studies also show that adult family members may adopt distinct mediating roles and that contingent parental scaffolding can support children's exploratory engagement (Ji et al., 2026; Wang et al., 2026).

1.4.2 School visits

In this study, school visits are conceptualized as non-formal learning experiences: they occur outside the classroom but are organized, curriculum-related, and pedagogically mediated. School groups may therefore enter the same physical environment with more explicit educational expectations than family groups. Prior research also shows that school-group conversations can support exhibition interpretation and knowledge construction (Tunnicliffe, 2000).

In contrast, school visits may be more structured and curriculum-oriented, which may influence the type and degree of students' engagement. Within the contextual model, this can be seen as a different sociocultural configuration that shapes how motivation becomes manifest through behavior.

These differences also have implications for science teacher education because the way teachers frame a visit, pose questions, and direct attention can shape how student engagement becomes visible. Recent work emphasizes that teachers and prospective teachers require pedagogical preparation to use zoo visits as purposeful out-of-school learning experiences rather than as unstructured excursions (Wolf et al., 2025).

1.5 Study rationale and research questions

In the present study, learning motivation is not directly measured through psychometric scales. Rather, it is interpreted through contextual and behavioral indicators observed during visits to the Izmir natural wildlife park. This approach is consistent with out-of-school science education research that emphasizes engagement as a visible expression of motivational processes within specific contexts.

The importance of this study lies in its focus on how motivation is expressed contextually rather than assumed as a fixed internal trait. Comparing family and school visits may seem unsurprising because the two visit configurations differ structurally; however, the contribution of the study is to show how these differences are expressed within the same physical wildlife park through dwell time, label engagement, social mediation, reported information sources, and perceived learning.

Despite growing research on out-of-school science learning, fewer studies have compared how family- and school-based visit purposes are expressed through observable

engagement within the same wildlife-park setting. The present study therefore examines whether different visit purposes correspond to different patterns of engagement that may reflect variations in motivational activation.

The study was guided by two research questions: (1) how do different visit purposes and visit configurations correspond to observable engagement patterns that may reflect variations in motivational activation? (2) how do family and school visitors differ in their perceptions of learning, reported information sources, and awareness of corrected or revised knowledge?

2 Method

2.1 Research Design

This study employed a qualitative case study design to examine how visit purpose and visit configuration were associated with engagement patterns in an out-of-school science learning environment. A case study approach was selected because it allows for in-depth exploration of a bounded system within its real-life context (Merriam, 1988). The bounded case in this research was defined as middle school students' visits to the Izmir Natural Wildlife Park under two distinct sociocultural configurations: family groups and school groups.

The study was theoretically grounded in the Contextual Model of Learning (Falk & Dierking, 2013), which conceptualizes learning in out-of-school environment as the dynamic interaction of personal, sociocultural, and physical contexts. This framework guided both data collection and interpretation, enabling the analysis of visit purpose (personal context), group mediation (sociocultural context), and environmental affordances (physical context) as interrelated components shaping engagement.

2.2 Study Group

The population of the study consisted of middle school students aged 11–14 visiting the Izmir Natural Wildlife Park. A non-probability convenience sampling strategy was employed due to accessibility and voluntary participation during scheduled visit days. The final sample included 119 students.

Participants were categorized into two groups based on visit configuration:

- 71 students visiting with family groups (minimum four individuals, including at least one adult)
- 48 students visiting with two school classes under teacher supervision

The distinction between family and school groups was analytically significant, as it represented two different sociocultural mediation structures within the same physical environment. Rather than comparing groups statistically, the study sought to explore how differing social configurations corresponded to observable engagement patterns. Prior

visitation experience was treated as descriptive background information rather than as a primary finding. This information was used to contextualize participants' familiarity with the wildlife park before interpreting their engagement and learning-related responses.

Table 1. Descriptive background: prior visitation experience

Visit Configuration	With Family F (%)	With School F (%)	With Friends F (%)	No Prior Visit F (%)
Family group (n=71)	20 (28.2)	17 (23.9)	5 (7.1)	29 (40.8)
School group (n=48)	20 (41.6)	4 (8.4)	4 (8.4)	20 (41.6)

2.3 Data Collection Instruments

Data were collected through semi-structured interviews and systematic observations. Six open-ended questions were administered individually to participating students. The questions addressed:

- Visit purpose
- Prior visitation experience
- Perceived learning effectiveness
- Newly learned information
- Sources of information
- Awareness of corrected misconceptions

The interview protocol was reviewed by two subject-matter experts: one academic specializing in science education and out-of-school learning environments and one academic with expertise in qualitative research methodology. Their feedback was used to revise the wording of interview questions, check whether the items were aligned with the contextual model framework, and ensure that the questions could elicit data on visit purpose, perceived learning, information sources, and misconception awareness.

The items on perceived learning effectiveness, newly learned information, information sources, and corrected misconceptions were analyzed as secondary evidence of participants' perceived learning in the out-of-school environment, rather than as direct measures of internal motivation.

2.4 Observational Protocol

The observation checklist was developed through review of previous out-of-school science learning studies and expert feedback. The two experts evaluated whether each indicator was observable in the field, conceptually related to engagement, and feasible to record consistently during naturalistic visits.

- Time spent at animal shelters (dwell time)
- Reading of interpretive labels
- Verbal and non-verbal interaction patterns
- Group mediation behaviors

These indicators were not treated as direct measures of internal motivation but as behavioral expressions of engagement within a specific contextual configuration.

To ensure consistency, the observation checklist included operational definitions for each indicator. Dwell time referred to the duration spent in front of an animal shelter; label engagement referred to visible reading or photographing of interpretive signs; interaction patterns referred to verbal or non-verbal exchanges among children, family members, peers, teachers, or staff; and group mediation referred to adult, teacher, or peer actions that directed attention, prompted questions, or supported interpretation.

2.5 Data Collection Procedure

Data were collected over three weekends during regular visitation hours. Participation was voluntary. Observations were conducted by the primary researcher, who accompanied both family and school groups during their visits and recorded field notes in real time using the same structured checklist across all observation days. There was no second observer; therefore, inter-observer reliability could not be calculated.

Dwell time at animal shelters was measured to identify patterns of sustained attention. Interaction behaviors, including label reading and dialogic exchanges, were documented descriptively. Following the visit, students participated in individual semi-structured interviews.

Consistency in observation was supported by the use of predefined categories, uniform recording criteria, and the same procedural sequence across visits. For each group, the observer recorded the same four domains: dwell time, label reading, interaction type, and group mediation behaviors. These procedural controls were used to reduce variation in observational recording across family and school visits.

The analysis of learning motivation was not based on psychometric measurement. Instead, motivation was interpreted through contextually observable engagement behaviors, consistent with out-of-school learning research that conceptualizes motivation as socially situated and behaviorally expressed.

2.6 Data Analysis

Interview data were analyzed using qualitative content analysis. All responses were transcribed and read multiple times to achieve immersion in the dataset. Open coding was conducted inductively to identify recurring meaning units. For example, the raw response “I came to have fun and see the elephant” was first segmented as a meaning unit, coded as “entertainment” and “seeing the elephant,” and then placed under the broader theme of

“visit purpose.” Similarly, a statement such as “I learned that gorillas live in Africa” was coded as “habitat information” and grouped under the theme of “content learning.” Codes were then grouped into broader thematic categories related to visit purpose, knowledge articulation, information sources, and awareness of misconceptions. The thematic categories were developed through a combined inductive and deductive process. Initial codes emerged inductively from students’ responses, whereas the broader analytic organization was informed by prior technology education literature and the contextual model of learning, particularly the personal, sociocultural, and physical contexts. The analytic procedure was informed by established qualitative content and thematic analysis approaches emphasizing repeated reading, meaning-unit identification, open coding, category development, and iterative comparison across cases (Braun & Clarke, 2006; Miles et al., 2014; Patton, 2015). These methodological sources were used to make the coding process more transparent and auditable.

The coding framework was refined through iterative comparison between raw responses, codes, and themes. Two field experts reviewed the category definitions and the fit between representative responses and thematic categories. Formal inter-coder agreement coefficients were not calculated because the coding was conducted by the primary researcher; however, expert feedback was used to resolve ambiguous codes and strengthen conceptual coherence.

Observational data were analyzed descriptively to identify patterns in dwell time, label engagement, and interaction structures across visit configurations. Although frequencies and percentages are presented to illustrate distribution patterns, these quantifications were used descriptively rather than inferentially. No statistical comparisons were conducted. The analytical approach remained interpretive and aligned with the qualitative case study design.

Throughout analysis, findings were interpreted within the Contextual Model of Learning framework, enabling integration of personal, sociocultural, and physical contextual dimensions.

2.7 Trustworthiness and Reflexivity

Several strategies were employed to enhance trustworthiness. First, methodological triangulation was achieved through the integration of interview data and systematic observations. Second, expert review was used during instrument development and category refinement to support content validity. Third, the researcher maintained reflexive awareness throughout data collection and analysis, recognizing the potential influence of interpretive bias in observational contexts.

These strategies were aligned with qualitative trustworthiness criteria, particularly credibility, dependability, and confirmability (Lincoln & Guba, 1985). Credibility was supported through triangulation between interviews and observations; dependability was supported through a structured observation protocol and consistent coding criteria; and confirmability was supported through reflexive attention to the researcher's interpretive

role. Findings were reported with attention to contextual grounding, and interpretations were framed cautiously to avoid causal claims regarding internal motivational constructs.

2.8 Context of the Study: Izmir Natural Wildlife Park

The Izmir Natural Wildlife Park provided the bounded physical context of the case. As Turkey's first natural wildlife park and a member of the European Association of Zoos and Aquaria (EAZA), it houses approximately 1,500 animals across more than 125 species. The park includes open enclosures, interpretive signage, and an Education Hall where structured educational activities are conducted.

The park's reliance on visual observation and written interpretive labels makes it a suitable site for examining how visitors engage with scientific content under varying social configurations.

The physical characteristics of the natural wildlife park, including its open spaces, shelter design, educational hall, and interpretive materials, constitute the physical context component of the contextual model of learning. These features may influence how visitors move through the space, interact with exhibits, and engage in learning-related behaviors. In addition, the Education Hall houses the Zoology and Skeleton Museum, where skeletons, skin, fur, horns, feathers, eggs, and other materials belonging to animals that have lost their lives over time are displayed.

3 Findings

Interview and observational findings are presented together to show how visit purpose and visit configuration were associated with different forms of engagement in the Izmir Natural Wildlife Park. The interview findings are summarized in Tables 2-6, while the observational findings are presented comparatively in Table 7. To avoid repetition of the numerical information already provided in the tables, the narrative focuses on the main patterns and their interpretive relevance to the research questions.

3.1 Visit purpose

As shown in Table 2, visit purpose differed clearly between family and school groups. Family-group children were predominantly oriented toward entertainment, whereas school-group children more frequently described the visit as a learning-oriented activity. This contrast suggests that the same physical setting was approached through different personal and institutional frames. In this respect, visit purpose functioned as an important component of the personal context, shaping how children engaged with the park environment.

Table 2. Purpose of Visit by Visit Configuration

Visit purpose	Family group f	Family group %	School group f	School group %
Entertainment	60	60.0	10	16.4
Learning	7	7.0	38	63.3
Entertainment and learning	9	9.0	8	13.1
Morale before exams	13	13.0	5	8.2
Seeing the elephant	11	11.0	—	—

Note. Multiple codes were possible; therefore, percentages were calculated separately for each code. Dash indicates no response reported in the available data.

3.2 Perceptions of learning effectiveness

Participants' responses regarding where they believed they would learn more effectively are summarized in Table 3. Across both visit configurations, children most often associated school-led visits with greater learning potential. This pattern indicates that formal educational framing influenced how children recognized and valued learning in the out-of-school environment. Although family visits supported social interaction and informal exploration, school visits were perceived by most participants as more directly connected to learning.

Table 3. Perceived Learning Effectiveness by Visit Configuration

Perceived setting for more effective learning	Family group f	Family group %	School group f	School group %
With family	15	21.1	8	16.7
With school	52	73.2	37	77.0
With friends	4	5.6	3	6.3

Note. Percentages are based on responses within each visit configuration.

3.3 Reported learning content

Table 4 presents the types of new information that children reported learning during the visit. School-group children more frequently articulated specific content-related learning, particularly animal names and habitat information. In contrast, family-group children more often reported that they had not learned new information or could not recall specific information. This difference suggests that teacher guidance and structured attention may have supported more explicit content articulation among school-group participants.

Table 4. Reported Learning Content by Visit Configuration

Reported content	Family group f	Family group %	School group f	School group %
Animal names	15	16.6	35	42.6
Habitats	10	11.1	29	34.5
Feeding habits	13	14.4	15	17.9
Not learned or could not recall	43	47.7	5	6.0

Note. Multiple codes were possible; therefore, percentages were calculated separately for each code.

3.4 Sources of information

As presented in Table 5, information sources differed according to visit configuration. Family-group children primarily referred to family elders and interpretive signs, whereas school-group children most often identified teachers as their main source of information. This finding highlights the role of social mediation in shaping how children accessed and interpreted scientific content. In family visits, learning appeared to be mediated mainly through parental or adult explanations and occasional use of signage. In school visits, teacher prompts and peer interaction created a more structured pathway for engaging with the interpretive materials.

Table 5. Information Sources by Visit Configuration

Information source	Family group f	Family group %	School group f	School group %
Teachers	—	—	34	54.1
Family elders	43	50.6	—	—
Signs	40	47.1	17	26.6
Friends	—	—	11	17.2
Curators/specialized staff	2	2.3	2	3.1

Note. Multiple codes were possible; therefore, percentages were calculated separately for each code. Dash indicates no response reported in the available data.

3.5 Awareness of corrected or revised knowledge

Participants were also asked whether they noticed any information that they had previously known incorrectly or incompletely. As shown in Table 6, children in both groups reported corrected or revised knowledge related to animal names, habitats, feeding habits, species classification, homeland of animals, and interesting facts. These responses were not interpreted as direct evidence of internal motivation. Rather, they were used as indicators of perceived learning-related change after the visit. The examples suggest that both family and school visits provided opportunities for conceptual clarification. The distribution of corrected-knowledge categories was mixed across the two groups; therefore, table 6 is interpreted descriptively rather than as evidence of stronger clarification in either visit configuration.

Table 6. Awareness of Corrected or Revised Knowledge

Category	Family group f	Family group %	Family group sample statement	School group f	School group %	School group sample statement
Animal names	6	21.4	K44: I thought the hawk and the falcon were the same bird.	5	25.0	K24: I thought the falcon and the hawk were the same bird.
Habitats	8	28.6	K29: Gorillas live in Africa while orangutans live in Asia.	2	10.0	K31: Camel wrestling is in our region, yet camels are desert animals.
Feeding habits	4	14.3	K12: Some vultures eat grass/plants.	3	15.0	K17: Bears are also herbivorous animals.
Homeland of animals	3	10.7	K48: The homeland of the budgerigar is Australia; I thought it could be anywhere.	3	15.0	K19: Lemurs only live in Madagascar.
Species	3	10.7	K8: I thought lemurs were part of the monkey family, but it turns out they are not monkeys.	4	20.0	K7: The orangutan is also a monkey. Pythons and anacondas are snakes from different families.
Interesting facts	4	14.3	K22: Parakeets are migratory birds. K16: The mon-goose is the animal we know as the weasel.	3	15.0	K40: The giant Galapagos tortoise lives between 100 and 150 years.

Note. Percentages are based on participants who reported corrected or incomplete knowledge (family group, n = 21; school group, n = 13). Multiple codes were possible.

3.6 Observational engagement patterns

Observational data provided additional evidence of differences in engagement between the two visit configurations. As summarized in Table 7, school groups displayed more visible structured engagement, including longer dwell time, more frequent label engagement, and more teacher- or peer-mediated discussion. Family groups showed more intra-group social interaction but less systematic engagement with interpretive materials.

The average dwell time at animal shelters was longer among school groups than family groups. School-group children were more frequently observed reading labels, taking photographs of signs, responding to teacher questions, and discussing animal-related information with peers. In contrast, family-group children generally spent shorter periods in front of shelters, moved more rapidly between exhibits, and interacted mainly within their own family units. Their engagement was therefore more recreational and socially oriented, whereas school-group engagement was more explicitly learning-oriented and content-focused.

Table 7. Comparative Summary of Observational Engagement Patterns

Observational indicator	Family groups	School groups
Average dwell time at shelters	Approximately 1 min 50 sec; brief viewing and rapid movement between shelters.	Approximately 4 min 17 sec; longer attention to shelters and interpretive materials.
Label engagement	Limited visible label reading by children or adults.	Frequent label reading encouraged by teachers; some children photographed labels.
Verbal interaction	Mostly intra-family conversation; limited content-focused dialogue with other visitors or staff.	Teacher-guided and peer-supported discussion around animals, shelters, and labels.
Non-verbal interaction	Looking, pointing, and moving between shelters were common; sustained attention to interpretive signs was limited.	Pointing, photographing labels, gathering around signs, and following teacher prompts were more visible.
Group mediation	Adult mediation was mostly informal and socially oriented.	Teacher mediation was structured through prompts, questions, and guidance to read labels.
Interpretive relevance	Engagement was mainly recreational, affective, and social.	Engagement was more explicitly learning-oriented and content-focused.

Note. min = minutes; sec = seconds. Observational findings were used descriptively to compare engagement patterns across visit configurations.

3.7 Integrated interpretation of interview and observational findings

Taken together, the interview and observational findings indicate that visit purpose and visit configuration were associated with different engagement patterns within the same physical environment. Family visits were characterized by entertainment-oriented purposes, intra-family interaction, and more informal forms of meaning-making. School visits were characterized by learning-oriented purposes, longer dwell time, greater attention to labels, and teacher-mediated content engagement.

These findings answer the main research question by showing that different visit purposes corresponded to different observable engagement patterns that may reflect variations in motivational activation. They also address the secondary research question by showing that children's perceptions of learning, reported information sources, and awareness of corrected misconceptions differed according to whether they visited the park with family members or as part of a school group. Thus, motivation in this study should not be understood as a fixed internal trait, but as a contextually expressed process shaped by personal purpose, sociocultural mediation, and the affordances of the out-of-school science learning environment.

4 Discussion

This study examined whether different visit purposes and visit configurations corresponded to different observable engagement patterns in the same out-of-school science

learning environment. The findings indicate that they did. Family-group children generally framed the visit through entertainment, social experience, and shared family time, whereas school-group children more often framed the visit as a learning-oriented activity. These patterns were also visible in the observations: school groups displayed longer dwell time, more frequent engagement with interpretive labels, and more explicit content-focused talk, while family groups showed more informal intra-group interaction and shorter engagement with written interpretive materials.

The purpose of this interpretation is not to claim that the difference between family and school visits is unexpected. As the literature on formal, non-formal, and informal learning suggests, school-mediated and family-mediated visits begin from different social and institutional starting points (Eshach, 2007; Stocklmayer et al., 2010). The contribution of the present study is more specific: it shows how these different starting points became behaviorally visible within the same physical environment. In other words, the wildlife park provided a shared physical context, but children's engagement was shaped by different personal agendas, forms of adult mediation, and institutional expectations. This interpretation is consistent with the Contextual Model of Learning, which emphasizes the interaction of personal, sociocultural, and physical contexts in informal and out-of-school learning (Falk & Dierking, 2013).

Visit purpose can therefore be understood as a component of the personal context. However, children's stated purposes should not be interpreted as purely individual choices. In the family group, the child's presence at the park depended on adult facilitation, family scheduling, and parental decisions about leisure, recreation, or learning. In the school group, the visit was institutionally organized and framed by teacher expectations. Thus, the motivational orientation reported by children was embedded in wider social arrangements rather than located only within the individual learner. This point is important because it prevents an overly psychological reading of motivation and supports a more contextual interpretation of engagement.

Prior visitation experience also provides an important contextual layer. A substantial proportion of participants had visited the park before, and many prior visits had occurred with families. Familiarity with the physical environment may have influenced how children moved through the park, how much attention they gave to signs, and whether they experienced the visit as exploration, repetition, recreation, or learning. For some children, previous family visits may have reduced the novelty of the physical setting and encouraged faster movement between shelters. For others, prior familiarity may have supported more confident engagement or made it easier to recognize corrected information. Because prior experience was treated descriptively rather than analytically in this study, it should be considered a plausible contextual influence rather than a confirmed explanatory variable.

The findings also require a careful interpretation of family-mediated learning. Family-group children reported family elders as important sources of information. Therefore, limited visible label reading should not be interpreted as an absence of learning. Parents or other adults may have verbally transmitted information that was available on signs,

translated exhibit content into familiar language, or connected observations to previous family knowledge. This aligns with research showing that family learning in museums and similar environments often occurs through conversational, relational, and socially negotiated processes (Ash, 2004; Callanan et al., 2020). From this perspective, family visits may support forms of affective, experiential, and intergenerational learning that are less easily captured through factual recall or visible label engagement. This interpretation is consistent with recent empirical work showing that verbal guidance strategies, facilitation, and written labels may shape family learning in different ways; therefore, low label use should be interpreted together with family conversation and adult mediation (Franse et al., 2021; Letourneau et al., 2021).

Recent evidence further indicates that adult family members may assume different mediating roles and that parental scaffolding can shape children's exploratory engagement and interaction patterns in museum settings (Ji et al., 2026; Wang et al., 2026).

At the same time, school-group children more often articulated specific content knowledge, such as animal names and habitat information. This pattern may reflect the teacher's role in directing attention, asking questions, encouraging label reading, and connecting observations to curriculum-related content. Structured field trips have been shown to strengthen content-focused learning when they include clear educational intentions and guided activities (Morag & Tal, 2012). In the present study, teacher mediation appeared to make learning more visible through observable behaviors such as reading labels, photographing signs, responding to prompts, and discussing animal-related information with peers.

The finding that children in both groups associated school-led visits with greater learning potential is also significant. This does not necessarily mean that family visits were less meaningful. Rather, it suggests that children may recognize learning more readily when it is connected to formal educational authority. Teachers, school tasks, and curriculum-related framing may make learning more explicit and more reportable. Family learning, by contrast, may be experienced as conversation, enjoyment, curiosity, or shared observation, and may therefore be less frequently described by children as formal learning. Similar interpretations have been offered in studies emphasizing that learning in museums, zoos, and other out-of-school settings is shaped by visitors' cultural expectations and social interactions (Falk & Dierking, 2013; Mujtaba et al., 2018).

The physical context of the wildlife park also shaped engagement. Unlike many museum settings, natural wildlife parks involve live animals, open spaces, movement between shelters, and strong sensory and affective stimuli. These features may encourage attention, curiosity, enjoyment, and emotional engagement, but they may also compete with written interpretation. Therefore, the limited use of labels in family groups may partly reflect the attraction of direct animal observation rather than a lack of interest in learning. Recent studies of zoological learning similarly emphasize the role of emotional engagement and curiosity in supporting science interest (Photo, 2024; Photo & Shabalala, 2025). Recent zoo and aquarium education reviews emphasize that learning outcomes are

multidimensional, including cognitive, affective, attitudinal, and behavioral dimensions, and that outcomes may depend on prior experience, staff interaction, program format, visitor characteristics, and the nature of the educational intervention (Baur, 2025; McNally et al., 2025; Schilbert & Scheersoi, 2023).

Taken together, the findings support the view that learning motivation in out-of-school science learning environments can be interpreted as contextually expressed engagement rather than as a stable internal trait. Dwell time, label reading, interaction patterns, reported information sources, and awareness of corrected misconceptions provide evidence of how motivation became visible in practice. However, these indicators should be interpreted cautiously. They show expressed engagement, not the full internal motivational state of the learner. This distinction is central to the theoretical framing of the study and to the interpretation of the results.

This contextual interpretation is also consistent with recent evidence showing that students' state interest can change within a guided museum visit and is systematically related to how the learning situation is perceived (Roemer et al., 2026).

5 Implications for Out-of-School Science Education Practice and Policy

The findings have implications for out-of-school science institutions, zoo educators, science teachers, teacher candidates, and educational policy. These implications should not be read as suggesting that wildlife parks, zoos, aquariums, or museums do not already recognize multiple visitor purposes. Many such institutions already provide entertainment-oriented and learning-oriented opportunities, including feeding demonstrations, keeper talks, guided tours, educational halls, and family activities. The present findings instead suggest that these existing opportunities may become more educationally visible when they are intentionally connected to visitor agendas and accessible forms of mediation.

For out-of-school science institutions, the results indicate the value of layered interpretive design. Family visitors may not always seek formal instruction, yet they can still benefit from brief and low-demand learning supports. Short conversation prompts, child-friendly observation cards, family question trails, QR-based micro-guides, or small signs that invite comparison and prediction could support learning without reducing the recreational quality of the visit. Such tools may be especially useful when families do not participate in formal guided tours or when staff-led programs are limited in time, availability, or cost.

Recent evidence suggests that light-touch supports such as facilitated prompts, written labels, minimal guidance strategies, and storytelling-based interventions can promote family engagement while preserving child agency and free-choice exploration (Franse et al., 2021; Letourneau et al., 2021; Manyukhina et al., 2024).

The findings also point to the importance of access and equity. If structured programs enhance parent-child or teacher-child discourse, families should be able to access at least some of these supports without significant financial or logistical barriers. Wildlife parks and similar institutions could consider free scheduled mini-talks, downloadable family activity sheets, low-cost guided routes, or open-access digital materials. These supports may help families transform recreational visits into richer science learning experiences while preserving autonomy and enjoyment. Recent equity-oriented reviews of informal STEM learning emphasize that out-of-school programs should support access, recognition, belonging, agency, and supportive relationships, particularly for underserved learners (Çolakoğlu et al., 2023).

For science teachers, the study highlights the pedagogical importance of pre-visit, during-visit, and post-visit planning. Teacher guidance was associated with longer dwell time, more frequent label reading, and more explicit content articulation. Therefore, school visits should not be treated as simple excursions. They should be designed as learning sequences that include pre-visit orientation, focused observation tasks, field-based questioning, and post-visit reflection. Such structuring can help students connect direct observation of animals with scientific concepts, ecological relationships, and prior classroom learning. This implication is consistent with recent evidence that follow-up activities and self-regulated learning strategies predict medium-term learning after museum visits, suggesting that pre-visit and post-visit pedagogical design should be treated as central components of out-of-school science learning (Lewalter et al., 2025).

For teacher education programs, the implication is not only that prospective teachers should be taught skills for using out-of-school environments, but also that they should be given opportunities to practice organizing and evaluating field trips. Teacher candidates could plan visits together with in-service teachers, develop observation protocols, test student activity sheets, practice dialogic questioning in the field, and reflect on how different forms of mediation influence student engagement. Such practice-based preparation would align teacher education more closely with the realities of out-of-school science learning (Guralp et al., 2024; Wolf et al., 2025).

At the policy level, the findings suggest a need for concrete mechanisms that support collaboration between schools and out-of-school science institutions. Policy support may include transportation funding for schools in rural or socioeconomically disadvantaged areas, subsidized or free school visit days, institutional partnerships between schools and wildlife parks, professional development programs for teachers, and publicly funded educational materials that help teachers and families use such environments more effectively. These forms of support would move beyond general recognition of wildlife parks as educational spaces and address the practical conditions that make meaningful participation possible.

Overall, the practical implication of the study is that engagement in out-of-school science environments can be strengthened through accessible mediation. For school groups, this mediation is often provided by teachers. For family groups, it may need to be

supported through prompts, guides, conversations, and institutionally designed opportunities that remain flexible, affordable, and compatible with recreational visiting.

6 Limitations and Future Research

Several limitations should be acknowledged. First, learning motivation was not directly measured using a validated psychometric instrument. Instead, it was inferred from observable engagement indicators such as dwell time, label reading, interaction patterns, and reported learning. This approach is theoretically consistent with the study's contextual framing, but it limits claims about internal motivational states. Future studies could combine behavioral observation with motivational scales, situational interest measures, or interviews designed to capture internal motivational processes more directly.

Second, the study was conducted in a single natural wildlife park and relied on convenience sampling. The findings are therefore context-bound and should not be generalized uncritically to other out-of-school science learning environments such as science centers, aquariums, botanical gardens, or interactive museums. Comparative research across different institutional settings would help clarify which findings are specific to wildlife parks and which are more broadly applicable to out-of-school science learning.

Third, the observational data were collected by a single researcher. Although the use of a structured observation protocol supported consistency, inter-observer reliability could not be calculated. Future research should involve multiple observers, pilot observations, and formal inter-rater reliability procedures to strengthen dependability and reduce observer-related bias.

Fourth, prior visitation experience was included as descriptive background information but was not analyzed as a major explanatory factor. Familiarity with the park may influence motivation, attention, movement patterns, label use, and recall. Future studies could compare first-time and repeat visitors more systematically to examine how novelty and familiarity shape engagement in wildlife parks.

Fifth, the study focused on children's perspectives and did not directly examine the agendas of parents, teachers, or institutional educators. However, children's visit purposes were partly shaped by adults who facilitated or organized the visit. Future research should therefore include parent and teacher interviews to examine how adult intentions, expectations, and mediation strategies influence children's engagement and perceived learning.

Sixth, the study mainly captured short-term engagement and immediate self-reported learning. Out-of-school science learning may develop over longer periods through memory, family discussion, classroom follow-up, or later encounters with related content. Future studies could include delayed interviews, follow-up tasks, or longitudinal designs to examine retention, affective outcomes, science interest, and possible contributions to STEM identity development.

Future research should also distinguish between cognitive, affective, attitudinal, behavioral, and identity-related outcomes, since recent reviews show that these outcomes are not interchangeable and may respond to different types of zoo or museum-based intervention (Baur, 2025; McNally et al., 2025; Schilbert & Scheersoi, 2023; Sonnert et al., 2025).

Finally, the study did not examine socioeconomic differences, cost barriers, transportation access, or the availability of structured family programs. These factors may strongly influence who can participate in wildlife park learning opportunities and how visitors use them. Future research should address equity and access more explicitly, particularly in relation to family participation and school visits from rural or disadvantaged communities.

Conclusion

This study examined how visit purpose and visit configuration were associated with observable engagement patterns in an out-of-school science learning environment. The findings show that family and school visits to the same natural wildlife park produced different forms of engagement. Family visits were more strongly associated with entertainment-oriented purposes, intra-family interaction, and informal adult mediation. School visits were more strongly associated with learning-oriented purposes, longer dwell time, teacher-guided label reading, and more explicit content articulation.

These findings answer the main research question by demonstrating that different visit purposes corresponded to different patterns of engagement that may reflect variations in motivational activation. They also show that motivation in this context should not be understood as a fixed internal characteristic of the child. Rather, motivation became visible through the interaction of personal purpose, sociocultural mediation, and the physical affordances of the wildlife park.

The study further shows that children recognized school-led visits as more effective for learning, even though family visits also provided meaningful opportunities for social and verbal learning through family elders. This distinction is important because it shows that learning in out-of-school environments may be visible in different ways: as explicit content recall in school groups, and as affective, social, or conversational engagement in family groups.

The main contribution of the study is therefore not the simple observation that school and family visits differ, but the demonstration of how these differences operate within a shared physical environment. By interpreting engagement through the Contextual Model of Learning, the study clarifies how visit purpose, adult mediation, institutional framing, and environmental design jointly shape the contextual expression of learning motivation. Future research that integrates behavioral, affective, and psychometric approaches may further deepen understanding of how motivation develops across diverse out-of-school science learning experiences.

Research ethics

Artificial intelligence

Artificial intelligence has been used in the writing of the article. ChatGPT Edu was used for language editing, including grammar check, spelling and correction of typographical errors. It did not contribute to the scientific content of the article.

Informed consent statement

Informed consent was obtained from all research participants.

Data availability statement

The data obtained cannot be shared anywhere, however, data kept by the author may be shared at the request of the journal editor.

Conflicts of Interest

The author declares no conflicts of interest.

References

- Affeldt, F., Tolppanen, S., Aksela, M., & Eilks, I. (2017). The potential of the non-formal educational sector for supporting chemistry learning and sustainability education for all students: A joint perspective from two cases in Finland and Germany. *Chemistry Education Research and Practice*, 18(1), 13–25. <https://doi.org/10.1039/C6RP00212A>
- Anderson, D., M. Storksdieck, & Spock M. (2006). The long-term impacts of museum experiences. In Principle, In Practice: New Perspectives on Museums as Learning Institutions, J. Falk, L. Dierking, and S. Foutz, eds., 197–215. Walnut Creek: AltaMira Press.
- Ash, D. (2004). Reflective scientific sense-making dialogue in two languages: The science in the dialogue and the dialogue in the science. *Science Education*, 88(6), 855–884. <https://doi.org/10.1002/sce.20002>
- Baur, A. (2025). What Do We Know About Children's And Adolescents' Formal And Non-Formal Learning In The Zoo? A Systematic Literature Review. *Animals*, 15(24), 3533. <https://doi.org/10.3390/ANI15243533>
- Braun, V., & Clarke, V. (2006). Using Thematic Analysis In Psychology. *Qualitative research in psychology*, 3(2), 77–101. <https://doi.org/10.1191/1478088706QP063OA>
- Briseño-Garzón, A., Anderson, D., & Anderson, A. (2007). Entry and Emergent Agendas of Adults Visiting an Aquarium in Family Groups. *Visitor Studies*, 10(1), 73–89. <https://doi.org/10.1080/10645570701263461>
- Callanan, M. A., Legare, C. H., Sobel, D. M., Jaeger, G. J., Letourneau, S. M., McHugh, S. R., Willard, A. K., & others. (2020). *Exploration, explanation, and parent-child interaction in museums. Monographs of the Society for Research in Child Development*, 85(1), 1–109. <https://doi.org/10.1111/mono.12412>
- Çolakoğlu, J., Steegh, A., & Parchmann, I. (2023). Reimagining Informal STEM Learning Opportunities To Foster STEM Identity Development in Underserved Learners. *Frontiers In Education*, 8, 1082747. <https://doi.org/10.3389/FEDUC.2023.1082747>
- Diamond, J. (1986). The Behavior of Family Science Museums. *Curator*, 29(2), 139–154. <https://doi.org/10.1111/j.2151-6952.1986.tb01434.x>
- Eshach, H. (2007). Bridging in-school and out-of-school learning: Formal, non-formal, and informal education. *Journal of Science Education and Technology*, 16(2), 171–190. <https://doi.org/10.1007/s10956-006-9027-1>
- Falk, J. H., & Dierking, L. (1997). Guest Editorial: Introduction. *Science Education*, 81(6), 629–631.

- Falk, J. H., & Dierking, L. D. (2013). *The museum experience revisited*. Routledge.
<https://doi.org/10.4324/9781315417851>
- Falk, J. H., Scoot, C., Dierking, L., Rennie, L., & Jones, M. C. (2004). Interactives and Visitor Learning. *Curator*, 47(2), 171-192. <https://doi.org/10.1111/j.2151-6952.2004.tb00116.x>
- Franse, R. K., Van Schijndel, T. J. P., Plankman, T. I., & Raijmakers, M. E. J. (2021). Families' Experiments And Conversations At An Open-Ended Exhibit In A Science Museum: Individual Characteristics And The Influence Of Minimal Guidance Strategies. *Science Education*, 105(4), 707-742.
<https://doi.org/10.1002/SCE.21620>
- Griffin, J., & Symington, D. (1997). *Moving from Task-Oriented to Learning-Oriented Strategies on School Excursions to Museums*. John Wiley & Sons, 763-779.
- Guralp, G., McHugh, M., & Hayes, S. (2024). Non-formal science education: Moving towards more inclusive pedagogies for diverse classrooms. *Center for Educational Policy Studies Journal*, 14(1), 105-142.
<https://doi.org/10.26529/cepsj.1707>
- Izmir Natural Wildlife Park. (2012). Retrieved May 14, 2017, from <http://www.izmirdogalyasamparki.org.tr/>.
- Ji, J., Anderson, D., & Rodewald, P. (2026). Adult Family Members' Roles in Mediating Children's Visits At A Chinese Science Museum. *Museum Management and Curatorship*, 41(4), 695-716.
[HTTPS://DOI.ORG/10.1080/09647775.2025.2467705](https://doi.org/10.1080/09647775.2025.2467705)
- Lewalter, D., Neubauer, K., & Moser, S. (2025). Self-regulated STEM learning in museums—the role of learner characteristics and visit-related activities in school. *International Journal of STEM Education*, 12, 56.
<https://doi.org/10.1186/s40594-025-00577-9>
- Letourneau, S. M., Meisner, R., & Sobel, D. M. (2021). Effects Of Facilitation Vs. Exhibit Labels On Caregiver-Child Interactions At A Museum Exhibit. *Frontiers In Psychology*, 12, 637067.
<https://doi.org/10.3389/FPSYG.2021.637067>
- Lincoln, Y. S., & Guba, E. G. (1985). *Naturalistic Inquiry*. Sage.
- Manyukhina, Y., Haywood, N., Davies, K., & Wyse, D. (2024). Young Children's Agency In The Science Museum: Insights From The Use Of Storytelling In Object-Rich Galleries. *International Journal Of Science Education, Part B*, 14(2), 177-193. <https://doi.org/10.1080/21548455.2023.2244645>
- McNally, X., Webb, T. L., Smith, C., Moss, A., & Gibson-Miller, J. (2025). A Meta-Analysis Of The Effect Of Visiting Zoos And Aquariums On Visitors' Conservation Knowledge, Beliefs, And Behavior. *Conservation Biology*, 39, E14237. <https://doi.org/10.1111/COBI.14237>
- Merriam, S. (1988). *Case study research in education: A qualitative approach*. San Francisco: Jossey-Bass.
- Miles, M. B., Huberman, A. M., & Saldaña, J. (2014). *Qualitative Data Analysis: A Methods Sourcebook* (3rd ED.). Sage.
- Morag, O., & Tal, T. (2012). Assessing learning in the outdoors with the field trip in natural environments (FiNE) framework. *International Journal of Science Education*, 34(5), 745-777.
<https://doi.org/10.1080/09500693.2011.599046>
- Mujtaba, T., Lawrence, M., Oliver, M., & Reiss, M. J. (2018). Learning and engagement through natural history museums. *Studies in Science Education*, 54(1), 41-67. <https://doi.org/10.1080/03057267.2018.1442820>
- Orion, N. & Hofstein, A. (1994). Factors that influence learning during a scientific field trip in a natural environment. *Journal of Research in Science Teaching*, 31(10), 1097-1119.
<https://doi.org/10.1002/tea.3660311005>
- Photo, P. (2024). Exploring the impact of zoological garden visits on primary school students' science learning: A qualitative examination of experiential and outdoor learning effects. *Journal of Outdoor and Environmental Education*, 28, 415-430. <https://doi.org/10.1007/s42322-024-00175-3>
- Photo, P., & Shabalala, N. P. (2025). "I felt happy to see animals because they are kind." How zoological environments shape primary school students' emotional engagement and interest in science learning. *Journal of Biological Education*, 1-23. <https://doi.org/10.1080/00219266.2025.2523345>
- Patton, M. Q. (2015). *Qualitative Research & Evaluation Methods* (4TH ED.). Sage.
- Rennie, L.J. & Johnston, D.J. (2004). The Nature of Learning and Its Implications for Research on Learning from Museums. *Science Education*, 88(S1), S4-S16. <https://doi.org/10.1002/sce.20017>
- Roemer, L., Beniermann, A., Upmeyer Zu Belzen, A., Moormann, A., & Ziegler, M. (2026). State Interest and Situation Perception in The Museum: Systematic Links in an Educational Context. *Contemporary Educational Psychology*, 85, 102460. [HTTPS://DOI.ORG/10.1016/J.CEDPSYCH.2026.102460](https://doi.org/10.1016/J.CEDPSYCH.2026.102460)
- Schilbert, J., & Scheersoi, A. (2023). Learning outcomes measured in zoo and aquarium conservation education. *Conservation biology*, 37(1), E13891. <https://doi.org/10.1111/COBI.13891>

- Sonnert, G., Reid, T., Sunbury, S., & Sadler, P. M. (2025). How do formal and informal science learning experiences during high school shape students' career interest and STEM identity? *International Journal of STEM Education*, 12, 55. <https://doi.org/10.1186/s40594-025-00568-w>
- Stocklmayer, S. M., Rennie, L. J., & Gilbert, J. K. (2010). The roles of the formal and informal sectors in the provision of effective science education. *Studies in Science Education*, 46(1), 1–44. <https://doi.org/10.1080/03057260903562284>
- Storksdieck, M. (2001). Differences in teachers' and students' museum field-trip experiences. *Visitor Studies Today*, 4(1), 8–12. https://www.researchgate.net/publication/265190064_Differences_in_teachers_and_students_museum_field-trip_experiences
- Tezcan Akmehmet, K. & Ödekan, A. (2006). The Historical Development of Museum Education. *ITU Journal*, 3(1), 47–58.
- Tolppanen, S., Vartiainen, J., Ikävalko, V.-M., & Aksela, M. (2015). *Relevance of non-formal education in science education*. In M. Juuti, K. Lavonen, R. Uitto, A. Byman, & J. Meisalo (Eds.), *Science education research: Engaging learners for a sustainable future* (pp. 335–352). Springer. https://doi.org/10.1007/978-94-6300-175-5_18
- Tunnicliffe, S.D. (2000). Conversations of family and primary school groups at robotic dinosaur exhibits in a museum: what do they talk about? *International Journal of Science Education*, 22(7), 739–754. <https://doi.org/10.1080/09500690050044071>
- Türkmen, H. (2010). Informal (Outside the Classroom). A historical perspective on science education and its integration into our education system. *Çukurova Education Faculty Journal*, 3(39), 46–59.
- Türkmen, H. (2015). Adults' Visiting Agendas in Informal Learning Environments: The Example of Sasalı Natural Wildlife Park. *Journal of European Education*, 5(1), 15–22.
- WANG, X., LI, Q., ZHANG, M., WANG, Y., & QIN, W. (2026). Lag Sequential Analysis of Parent–Child Interactions In Children's Museums. *Research in Science & Technological Education*, 44(3), 1330–1352. [HTTPS://DOI.ORG/10.1080/02635143.2025.2573197](https://doi.org/10.1080/02635143.2025.2573197)
- Wolf, R. L., Dierkes, P. W., & Kleespies, M. W. (2025). Zoos as educational and conservation spaces: Perspectives from (future) teachers. *Frontiers in Education*, 10, 1680014. <https://doi.org/10.3389/feduc.2025.1680014>
- Yun, S. T. (2023). A review of augmented reality for informal science learning: Design principles and visitor engagement. *Visitor Studies*, 26(2), 195–213. <https://doi.org/10.1080/10645578.2022.2075205>