Teachers, Museums and Worksheets:
A Closer Look at a Learning Experience

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The Unique Contexts of Museum Learning

Although many people may perceive the four-walled classroom as the principal place for learning, it is by no means restricted to that environment. For instance, most teachers would agree that a visit to a museum, science center, zoo or other informal science learning institution provides a valuable experience for their students. More and more, educational researchers have turned to informal settings to examine learning in these and other non-school environments. One area that has received growing attention within the past decade is the investigation of visitor learning in museums, science centers, zoos and similar public institutions. In their examination of the museum experience, Falk and Dierking (2000) have developed a model for learning that addresses the importance of the personal, social and physical contexts, all of which interact to influence learning in a museum or "free-choice learning" environment. This Contextual Model of Learning consists of eight factors, within the three different contexts, which can influence the learner in a museum (or other similar situation.) Falk and Dierking suggest that each of these factors should be considered when trying to understand (and improve) the learning experience:

1. Motivation and Expectations. People visit museums for different reasons and what they want to do or expect to see will certainly affect their overall experience.

2. Prior Knowledge, Interests and Beliefs. A visitor's interests and existing knowledge will influence choice of exhibits or programs for participation.

3. Choice and Control. Learning is optimized when the learner is in control and can choose what is intrinsically interesting.

4. Within-group Sociocultural Mediation. Museums are uniquely suited for social learning; visitors in groups utilize each other as vehicles for reinforcing beliefs and making meaning.

5. Facilitated Mediation by Others. Museum staff and other visitors can impact individual learning.

6. Orientation and Advance Organizers. Learning is more likely when visitors are familiar with their surroundings and their expected behaviors.

7. Design. Exhibit design can help or hinder an individual's interest and understanding.

8. Reinforcing Experiences Outside the Museum. Events and situations that occur beyond the museum itself can ultimately influence what is learned from a museum experience.

Thus teaching that occurs within a museum context, whether led by museum educators or teachers on school field trips, should take these factors into account. This may prove to be somewhat challenging, as traditional classroom teaching practice does not typically acknowledge the interaction of personal, social and physical contexts. This challenge will be examined within this study.

School Groups and Museums

Several researchers have shown that students have lasting memories of museum field trips, and in most cases, those memories involve both context and content (Falk & Dierking, 1997; Fivush, Hudson, & Nelson, 1984). But what do those experiences look like? Studies of school group field trips have revealed that teachers often have poorly defined goals for field trip visits, which subsequently affects student learning during these experiences (Griffin & Symington, 1997; Orion & Hofstein, 1994; Tuckey, 1992). A recent study of field trip learning revealed that only about 50% of the teachers interviewed were able to describe a purpose for the field trip that was related to student learning of subject matter or skills (Griffin & Symington, 1997). The authors further reported that less than half of the teachers interviewed for their study considered the trip to be linked to the classroom curriculum. In those cases, teachers tended to hold the museum responsible for this poor connection, in some cases stating that the exhibits were not quite what they were learning about back at school. Another investigation suggested that although most teachers identified "to enrich the curriculum" as a goal for the trip, none of them had done any special preparation for the trip or specific linking to their classroom lessons (Tuckey, 1992). So while teachers may see the trip as a valuable learning experience, they do not necessarily acknowledge *how* it is valuable and *how* they can contribute to student learning.

The blending of "formal" or classroom learning with the museum context seems to be a troublesome pairing in practice. Researchers have proposed that an optimal learning experience for school field trips would include pre-visit and follow-up activities (Bitgood, 1994; Falk & Dierking, 1992; Gennaro, 1981; Orion & Hofstein, 1994; Ramey-Gassert, Walberg III, & Walberg, 1994; Rennie & McClafferty, 1995). Such activities prepare students for the out-of-classroom learning experience by providing some prior knowledge that can aid in perception and attention while at the site, as well as strengthen new connections through elaboration and application afterward. Studies have also shown that pre-visit preparation should also include orientation to the agenda for the day—where students are going, what they will see, when they will visit the gift shop, and when they will eat. Unfortunately these preparatory and concluding activities are often not incorporated by teachers (Griffin & Symington, 1997). So while teacher intentions may be good, it seems that appropriate steps are not taken to best cultivate those intentions.

In fairness to teachers, taking field trips is not a particularly easy task. There are a multitude of logistical variables that must be accounted for before, during and after the trip, including parental permission slips, funding for transportation,

chaperones, scheduling, as well as administrator blessing. These factors potentially impact teacher goals for the visit. In addition, field trips place teachers in a teaching context that they may not be familiar with. Perhaps their skills are situated within the classroom environment. Or perhaps, their perception of what happens in this field trip environment conflicts with what happens in the school classroom. People behave in physical spaces according to socially determined roles and interactions. Environmental psychologists refer to this concept as rules of place (Canter, 1991). Although teachers may have a particular script for interaction within a museum, these rules of place may conflict with the learning context of the classroom, causing a confusion of goals.

Museum Worksheets

A strategy for teachers in museums involves student completion of a worksheet, either supplied by the institution or generated by the teacher. These devices have the potential to cue the students to the salient features of the exhibit (Rennie & McClafferty, 1995) and have been shown to improve student learning of particular exhibit objectives (Canizales de Andrade, 1989). In this way, the worksheets may be serving the role of advance organizer, helping students to organize their visit and provide support for the acquisition of new knowledge (Ausubel, 1977). However, similar attitudes toward worksheets and school visits are not shared by all informal educators. Price and Hein (1991) discourage the use of worksheets during a school visit to the museum, claiming that while they may be useful for focusing observation and assisting with identification, they can "actually impede student learning by inhibiting true observation, preventing students from formulating their own questions, and causing students to focus on the narrowly described task to the exclusion of broader questions"(p. 515). Griffin (1999) has noted that in many cases worksheets are designed by teachers for use with exhibit labels to the exclusion of the displays themselves, essentially reducing exhibits to textbooks.

Although worksheets may be problematic as learning devices, they do seem to have the potential for mediating a potentially confusing learning environment. Some suggested characteristics of successful worksheets include :(a) connections to activities that follow the field trip; (b) questions directed primarily toward objects, not labels; (c) variety of question types (short/long, open/closed, written/drawn); (d) unambiguous information regarding how or where information might be gathered; and (e) provisions for social (peer) interaction (Fry, 1987; Griffin, 1999; McManus, 1985).

If we accept that fact that well-constructed worksheets can influence student learning during a field trip, we must understand what these museum worksheets consist of in the first place. More importantly, we must examine the "worksheet experience" in context to better understand how it supports or restricts the overall student experience. As the field trip experience is clearly influenced by teacher intentions, especially when worksheets are generated by the teacher, this leads us to a window on teacher goals and even beliefs regarding museum visits.

Method

The overarching goal of this descriptive study was to gain a better idea of how teacher intentions and other factors influence the fieldtrip experience. Teacher-prepared worksheets, intended for these self-guided visits, were used as unique original artifacts that could provide information regarding teacher intent for school visits. By examining these worksheets (along with teacher interviews and group observations) a clearer sense of what happens on these school field trips, was hoped to be gained. Also sought was how these field trips may be related to teacher needs and concerns. In addition, the analysis of the worksheets led to a comparison of factors identified in Falk and Dierking's Contextual Model of Learning (Falk & Dierking, 2000), as well as recommendations by other researchers. This comparison resulted in a more detailed description of what an effective worksheet might look like.

Setting and Participants

This investigation took place at an urban natural history museum where a large proportion of the visitorship results from school visits. At the time of this study, teacher-guided visits were limited to two days per week , with the remaining days dedicated to docent-guided programs, which involved a traditional, more structured tour/lecture format. Self-guided tours accounted for nearly 113,000 visitors at the museum during the 1998-1999 school year (July 1, 1998 to June 30, 1999

It is worth noting that the majority of self-guided school groups that visit the museum *do not* come with a specific worksheet or student project. For the days examined in this study, the number of groups with worksheets was only about seven percent. Museum staff confirmed that these were typical rates throughout the school year. Thus the use of worksheets was clearly not the norm for this institution. However, these worksheets were seen as a useful source of information that could provide valuable insight into teacher objectives in a less threatening manner.

A total of twelve worksheets from twelve different schools in the Los Angeles area were examined. For eight of these school groups, teacher interviews and group observations were conducted in addition to worksheet analysis; the remaining four worksheets were analyzed without additional information. A total of ten teachers, from grades 3 through 11, were interviewed; two teachers led two of the eight school groups observed. In addition to the teacher or teachers, all groups also had at least one adult chaperone in their group, with some having as many as five.

Approach

A qualitative approach was used to gain an understanding of worksheet use. Content analysis of the worksheets, as well as interviews and observations were the primary modes of data collection. Worksheets were collected and classes were observed over several non-consecutive days in April (a busier time of year) and

again in December (a somewhat quieter period).

Teacher interviews and group observations were also used to inform the study. Purposeful sampling was used, as teachers entering the museum were identified for the study based on whether or not a worksheet was visible. After the school groups had gained entry to the museum and the visit was underway, the researcher approached the teachers, describing the purpose of the study and requesting a copy of the worksheet. Teachers were informed of the purpose of the study; the researcher then asked for permission to observe student groups and conduct a brief interview with the teacher. In all cases, teachers were asked if they would be willing to speak again via phone if necessary and in all cases, teachers seemed willing to help. A total of ten teachers were interviewed; all but three were contacted again (by phone, mail or email) for further clarification.

In some cases, chaperone-led groups from these same classes were observed. In several of these instances, chaperones were briefly interviewed; in other situations, the researcher simply observed the group in the public spaces. Several students were approached for comment as well (with teacher permission). While additional student feedback would have been useful in this investigation, the researcher found it difficult to gain entry to the students and conduct meaningful conversation within the time constraints of the museum visit. Observations of student behavior were recorded, however, as well as student-student and student-teacher dialogue.

Content analysis of the worksheets collected was used to identify several categories and subsequent properties that addressed the research questions. Open coding was utilized to discover properties and dimensions within the data. Worksheets, field notes and interviews were all carefully examined and coded to provide a richer data set. Categories were used to help contextualize the phenomenon of worksheet use and begin to develop a clearer picture. This categorization was also compared to other results and observations discussed in the literature.

Descriptive data for each of the groups was collected and organized in order to more easily compare basic differences (see Table 1). Questions were counted and in some cases, multi-part questions were counted as separate questions, if there was clearly a different task or idea introduced. From this simple summary, significant differences in worksheet strategies became apparent.

Findings

Analysis of worksheet contents along with corresponding interviews and observations revealed that the museum experiences were influenced not only by the design of the worksheets, but also by how those worksheets were used.

Worksheet Characteristics

Content analysis of the worksheets revealed eight distinct characteristics with implications for student learning. These characteristics included: task density, orientation cues, site specificity, information source, level of choice, cognitive level, response length, and response format.

Table 1. *School and Worksheet Data*

School	Grade	Visit time[1]	Number of halls/displays visited to complete worksheet	Number of questions on worksheet	Time per hall (T/H)	Time per question (T/Q)
1. Public Elementary	2nd/3rd	45 min–1 hr	1 hall (Birds)	3 multi-part questions	45 min	15 min
2. Private Academy	3rd	2 hr	9 halls + 5 displays (14)	33 questions	8.6 min	3.6 min
3. Public Elementary	3rd	1.5 hr	3 (worksheet, Mammal hall only)	4 questions	30 minute	7.5 min[2]
4. Public Elementary[3]	5th	approx. 2 hr	1 hall per team	15 questions	up to 2 hr	up to 8 min
5. Private School[3]	2nd	2 hr[4]	7 halls	7 multi-part questions	17 min	17 min
6. Private Elementary	5th/6th	2 hr	3 halls	21 questions	40 min	5.7 min
7. Public Middle School	6th	1.5 hr	13 halls	53 questions	6.9 min	1.7 min
8. Public Middle School	6th	1.5 hr	7 halls	15 questions	12.9 min	6 min
9. Public Middle School	6th	3.5 hr	any (13)[5]	5 questions	16.2 min	42 min
10. Public Middle School[3]	6th–8th	est. 2 hr	2 halls	34 questions	60 min	3.5 min
11. Public High School	9th (honors)	1.5 hr	9 halls	35 questions	10 min	2.6 min
12. Public High School	11th, 12th	est. 2 hr	4 halls	48 questions	30 min	2.5 min

Task density. A quick look at Table 1 shows that task density, or the amount of work students are asked to complete, varied significantly. In one case, third grade students were expected to traverse as many as 14 halls or displays within the museum over the course of approximately two hours; in another case, third graders were asked to spend about one hour in one hall. Another dimension of task density relates to the number of questions on these worksheets, which ranged from three questions over the course of 45 minutes to 53 questions over approximately 90 minutes. The time per question (T/Q) ratio and the time per hall (T/H) ratio provide an approximate standard for comparing the experiences of these students. A low T/H ratio indicates that, on average, there was a short time spent in each hall; a low T/Q ratio indicates a short amount of time allotted to answer each question, on average. Continuing this categorization, a worksheet with high task density would allow students only brief visitations in each hall, as well as short periods of time for completion of questions.

High task density is a dramatic illustration of "coverage" or the emphasis of breadth of topic over depth. Worksheets with low T/H and T/Q ratios suggest that less time is provided for students to examine the exhibits and think carefully about responding to each question; less time spent decreases the likelihood that students will be able to develop a deep or lasting understanding of the material. One ninth grader admitted that his visit "felt rushed, like we didn't have enough time" (school 11). Even the most well-intentioned teacher is faced with this dichotomy in the classroom as typical science textbooks, provide an extremely wide collection of topics to be addressed. The museum worksheets examined here seem to reflect a similar pressure to cover a lot in a little time.

Orientation cues. This property describes the extent to which the worksheet guides students through the museum. In several cases, these cues were very specific, directing students though each hall, step by step, even providing detailed directions of when to turn or where to look. Other worksheets provided more general directions, often in the form of the name of the hall where the answers would be found. One of the worksheets provided no orienting directions and did not even specify which hall the worksheet would be used in. The extent of orientation cues may reflect the teacher's desire to help the students answer the questions. However, observations and teacher interviews suggest that these cues may also indicate the teacher's desire to introduce structure or control in a potentially chaotic setting.

Site specificity. This worksheet characteristic reflects the extent to which learner tasks are based on a specific exhibit or even museum site. For most of the groups, worksheets were heavily dependent on specific displays and objects, often focusing on specific details. For one school, however, questions were focused on birds, but not particular features of the bird hall. This worksheet, which is more focused on a particular concept, might be of use at a different museum or zoo, suggesting low site specificity. Other worksheets were even less specific, asking students to examine an animal of their choice and then describe particular features, or simply asking students to write down five new things they had discovered in the museum. Examination of these worksheets suggested that those with low site specificity were more likely to focus on overarching concepts, rather that exhibit details.

Information source. Content analysis of each of the worksheets revealed a wide range of questions that could also be categorized by similar features. One of the distinguishing characteristics was related to the information source for the desired response. Was the answer found by reading label text (text-dependent) or by looking and thinking carefully about a particular object (object-dependent)? Object-dependent questions are more indicative of the unique physical context provided by the museum and the objects on display. However, label text was the dominant source of information for most of the worksheets examined. For one worksheet, which had only a few text-dependent questions, the teacher had remarked that she had included some of the questions because she knew that there were labels with some basic information about the animals. Even worksheets with high task density included a few object-dependent questions, like "Go to the marsh [area and] stand still for one minute. How many different bird sounds do you hear?" Note that an object-dependent question can also have low site specificity: "Choose one of the dinosaur skeletons and explain whether you think it was a carnivore or herbivore."

Level of choice. The amount of choice and control that each question afforded the student was another categorization that was observed. For this characteristic, questions ranged from no choice (only one correct answer), to some choice (with several possible answers or options for response), to subject choice (where students could choose the subject for which the question is asked. Sample questions illustrate these distinctions:

> *How many eggs does a Sea Turtle lay in 20 minutes?" school #7. (no choice)*

> *Give an example of each: Metamorphic, Sedimentary, and Igneous rock. school #7. (some choice)*

> *What else would you like to know about the animal [that you chose]? school #3. (subject choice)*

The level of choice afforded the student by the worksheet is also related to whether the worksheet activity is student-centered or museum-centered (analogous to comparing student-centered and teacher-centered classrooms). Although visitor choice is an important part of the museum experience, it was not a common element of the worksheets examined.

Cognitive Level. Another characteristic of these worksheet questions refers to the level of questioning used, as described by Bloom's taxonomy of processing in the cognitive domain (Bloom, Engelhart, Frost, Hill, & Krathwohl, 1956). Bloom describes six levels—knowledge, comprehension, application, analysis, synthesis, and evaluation—each involving a more complex process than the previous level. Nearly all of the questions on the worksheets examined were at the knowledge level, where students were simply asked to repeat or write what they had read or seen. While it may be unfair to expect high cognitive level synthesis or evaluation

questions on these museum worksheets, especially for the younger students, it does seem that more comprehension and application level questions could be easily incorporated into the experience. An example of an application question that was found was: "Describe how the external features help these animals thrive in the different environments of North America" (school #11, grade 9). Questions like this, however, were uncommon.

Response length. Another characteristic of these worksheet questions related to the length of the expected answer. Many of the worksheets prompted short one or two-word answers that were to be squeezed onto a short line. However, several of the worksheets did ask for more extended responses, such as:

Sketch and name at least three birds in the marsh. (school #2)

Describe how gold is found, made and prepared. (school #11)

Watch...video. Write down two things you learned. (school #7)

Note that length of response is not necessarily an indicator of a higher order or student-centered question. Although the use of extended responses might reflect a preference of in-depth understanding over breadth of topic, for the each of the examples above, the total number of questions on the worksheet was still greater than thirty.

Response format. This question characteristic refers to *how* the student was directed to respond. That is, were students directed to write, draw, touch, talk, or do something else? This property can be conceptualized along two dimensions: verbal-nonverbal and written-nonwritten. Figure 1 represents these dimensions graphically.
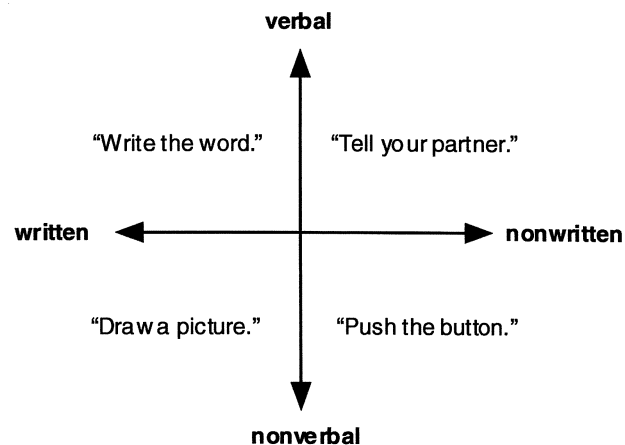

Figure 1. *Dimensions of response format*

Most of the student responses on the worksheets analyzed were verbal and written, not unlike a traditional classroom experience. For practical purposes, it is definitely much easier to account for student task completion (but not necessarily learning) if the task involves recording information. Several questions on one of the worksheets (school #7) did acknowledge some of the hands-on or experiential components in the halls and did direct the students to experience those components.

Feel the lion's tongue. All cats' tongues are covered with fleshy hooks called _____.

Put your hand in the dinosaur footprint. How many times larger is it than your hand?

Look at the ziggurat. Tell your chaperone what you know about ziggurats. Check here [on this line] when you have finished.

Note that in the first two cases, a verbal, written task quickly followed the nonverbal, nonwritten one. Even in the third question, after being asked to "tell what they know" in a verbal, nonwritten response, students are directed to a written task ("check here"). While the teacher here seems to acknowledge the range of experiences the students could participate in, it is apparent that accountability of learning was also an important issue.

The third question example above ("Tell your chaperone what you know...") is also one of the few instances where social interaction was explicitly stated on the worksheets. Falk and Dierking's (2000) model recognizes the importance of the social context in the museum experience. Yet rarely was social or cooperative learning encouraged though the text of these worksheets. In fact, observations revealed that while some of the students were instructed to work with partners, in all (observed) cases, each student was given their own individual worksheet to complete. This is not to say that students did not end up learning within a social context, as students were observed discussing the worksheets and exhibits in small groups throughout the visit. It does suggest, however, that this interaction was probably not explicitly recognized by the teacher as an important part of the learning experience. It is worth noting, however, that two of the worksheets acquired clearly indicated that students were to work in teams. Only one of those seemed to suggest that all group members would share one worksheet.

Teacher Influence and External Factors

While worksheets alone can provide information about the intended learning experience at the museum, teacher interviews and observation were very helpful in providing additional context. As in the classroom, teacher attitudes and experience played a significant role in creating the learning experience. Remember that worksheets examined were all teacher-generated. In addition to worksheet characteristics, several other factors emerged from the data analysis that had the

potential for influencing the field trip experience. In many cases, these external factors directly impacted how the worksheets were used.

Visit Purpose. Teachers were each asked about the purpose of the field trip. The question was left relatively unspecified, so as to gain an understanding of the extent to which these were learning goals. In several cases, purpose was in fact stated in terms of a learning objective, yet these objectives ranged over a continuum, from general overview to specific concept understanding. In only one case did a teacher plan to focus primarily on one hall (Birds), since that was what they were doing in class at that time. For the other teachers, the goal was some variation of a general introduction or survey of the museum or simply an opportunity for students to learn, in a very generic sense, outside of the classroom. One teacher (school #9) noted that his goal was for students "to see as much as possible."

Worksheet rationale. Teachers were also asked why they had asked their students to complete a worksheet as part of their visit. Teachers responded overwhelmingly that they did not believe students would learn or remember without the use of a worksheet. Several expressed their concern in terms of time on-task, explaining that the worksheet was necessary to keep students focused as they went through the museum. Interestingly, only one teacher explicitly referred to external factors (the crowded halls) as the reason why her students would have difficulty staying on-task. Thus teachers seemed to believe that the inherent informal nature of the museum was not, in and of itself, conducive to maintaining attention and facilitating learning.

Museum familiarity. In all but one case, interviewed teachers who developed the worksheet were already familiar with the museum. In two instances, these teachers had made a special trip to the Museum the weekend before in order to gather information for the worksheet. For the others, teachers were already acquainted with the museum through membership, family outings or prior school visits. In one case, a teacher wanted to visit the museum beforehand, but was unable to obtain the necessary information from the museum to do so. His teaching partner was able to get some information, however, via the museum's web site.

Classroom connection. Researchers have shown that museum visits often have little connection to the classroom curriculum and are viewed as separate events outside the curriculum. Many of the teacher responses in this study seem to support that assertion. Although most of the teachers stated that the experience related to some topic they had already addressed or were soon planning to cover, these connections seemed incidental to the overall experience. Pre-visit preparation and plans for post-visit follow up were minimal. In cases where teachers were contacted after the day of the visit, their account of follow-up was even less ambitious than originally described. It is worth noting that two of the teachers had brought their students to the museum as a result of a last-minute opportunity. Both teachers explained how they simply could not turn down such an opportunity for their class, even if it was not previously planned as part of their curriculum.

Teacher or chaperone involvement. Observations of these groups in the museum revealed that the level of teacher or chaperone involvement with the students greatly affected worksheet effectiveness. In one case (school #2), the teacher allowed

students to essentially lead themselves through the hall using a detailed worksheet. Although the worksheet questions were quite "museum-centered", the teacher allowed for student exploration as they searched for their answers. This particular teacher's interaction with her students helped temper the low-level, primarily text-based questions of the worksheet with some higher level questions that followed up on student observations and comments.

In contrast, other groups from that school, led by parent volunteers, were much more focused on task completion than enhancing learning experience. These chaperones typically kept the students moving ("OK. All done? We've gotta go.") and on-task ("Let's see if we can find that walrus.") At other times, chaperones took a less active role, apparently waiting until students appeared to be finished or explicitly mentioned that they were finished, before moving on. In those cases, the worksheet alone essentially directed student learning.

Discussion

The teacher comments and behaviors observed in this study resemble in some ways the responses reported in earlier studies (Griffin & Symington, 1997; Price & Hein, 1991; Tuckey, 1992). A lack of connections to the classroom curriculum was noted for nine of the ten teachers interviewed. These same teachers reported limited plans for follow-up activities that would support the visit, although a few described plans to briefly discuss the visit the next day. Yet unlike the other studies, all of the teachers examined here had some sort of plan for what their students would do; this plan took the form of completing a worksheet. So while this sample may or may not be typical of the average school group, it provides information about teachers who appear to have particular intentions for the field trip. As mentioned, all of the teachers described worksheet use as a way to keep students focused and on-task—without them, they believed, it was unlikely that learning would occur. Clearly, these teachers were making an effort to create a learning experience. What that experience would be, however, would depend on the teacher's interpretation of learning in the informal setting.

Teacher Agendas

According to Falk, Moussouri and Coulson (1998), museum visitor agenda influences the learning experience. In the case of teacher agendas, the experience of all the participating students, regardless of their own personal agenda, can be affected. Synthesis of the data collected suggests two broad, overarching teacher agendas: a *survey agenda* and a *concept agenda*. A teacher with a survey agenda would be most interested in having students see and experience the entire museum, or as much of the museum as possible. The students sample a little bit of everything, often with little time for extended observation or contemplation. In contrast, a teacher with a concept agenda would be more interested in using the museum for a specific goal, such as to clarify a particular concept or idea. The students are exposed to a few parts of the museum, as related to a particular topic, possibly a

subject from the classroom curriculum. These agendas reflect the teacher's goals and strategies for the visit. In a sense, these agenda might be interpreted as the teacher's curriculum for the field trip.

Each of these agendas can be described in terms of a particular pattern of worksheet characteristics and other external influences that in turn lead to different museum experiences for students. In the cases examined, worksheets that had more questions and covered more areas of the museum tended to allow limited student choice, require a greater amount of label-reading and rely on specific exhibit information. Teacher goals for these visits tended to be very general, involving "seeing it all" or having a "good learning experience." This suite of characteristics corresponds to the survey agenda. In contrast, the concept agenda was also suggested by a particular combination of characteristics, including worksheets with fewer questions, opportunities for more student choice, and a greater emphasis on student observation of objects rather than label reading. Table 2 describes these two approaches in terms of those characteristics that best illustrated the distinction between them.

Table 2.

Comparison of worksheet types

Distinguishing characteristics	Survey agenda worksheet	Concept agenda worksheet
Task density	Low T/Q, T/H ratios; more questions overall	Higher T/Q, T/H ratios; fewer questions overall
Orientation cues	Yes	Not always
Site specificity	Questions are very label- and exhibit-specific	Questions can be answered using a variety of exhibits or sites
Information source	Responses based primarily	More object-based questions on label text
Level of choice	Few, if any, choices for students	Some student choice incorporated into questions
Cognitive level	Less likely to use higher order questions	More likely to use higher order questions

Several worksheet and teacher characteristics were not distinctly different enough to be used in distinguishing these agenda types. Differences in response length and response format did not reveal noticeably different patterns for worksheets from different agenda classifications. The teacher's familiarity with the museum was likewise similar for both agendas. It is likely that this teacher characteristic, museum familiarity, is one of several predictors of whether the teacher might use worksheets in the first place.

The two agendas described here are by no means meant to classify teacher field trip goals into a tidy dichotomy. What happens during a museum visit may be affected by a multitude of factors, and it is likely that there are other dimensions along which teacher agendas could be described. However, the typology described here provides one way to better understand these school group learning experiences. It is also important to note that these different learning agendas are not mutually exclusive constructs. Aspects of many of the teacher-led tours reflected elements of both survey and concept development. For one school, the teacher had very general goals (opportunity, exposure) and limited connections to the classroom curriculum, but utilized a worksheet and methods that promoted concept development over breadth of knowledge. In another case, the teacher clearly stated that he wanted to try having students see as much of the museum as possible. Yet the worksheet questions the students answered were quite general, allowing students to choose what aspects of the exhibitry they wanted to comment on. The relationship between these agendas is probably better represented by a continuum rather than a sharp dichotomy. However, most of the teachers examined in this study (80%) would be located closer to the survey agenda end of the scale.

Worksheet Construction

Although some of the worksheets observed here were consistent with the recommendations for effective museum worksheets and museum learning as described by other researchers, most were not. The concept agenda worksheets allowed students to spend more time with fewer exhibits, and questions were more exhibit-based, as recommended by McManus (1985). However, only one of the teachers described extensive plans to connect the museum plans to their classroom, contrary to most recommendations for successful museum learning. The survey agenda worksheets did seem to reduce the museum to a "textbook" experience, with heavy emphasis on reading label copy, as reported by Griffin (1999). It is worth noting that orientation cues were more predominant for the survey worksheets, which is consistent with the idea that these teachers are more concerned about moving the students through the museum, with the goal of seeing as much as possible. Concept agenda worksheets encountered in this study had considerably fewer orientation cues. Unfortunately, this is counter to the idea that worksheets be straightforward and unambiguous about where information might be gathered (Fry, 1987). It would seem that the concept agenda worksheets, with their lack of site specificity, might contribute to student confusion and ultimately become an obstacle to learning. Finally, only two of the twelve worksheets examined were created with an explicit purpose for student teams, again suggesting that teachers were unaware of or possibly uncomfortable with the opportunity for unique cooperative learning experiences within the museum.

Using the worksheet and teacher characteristics derived from the data, the different components of a worksheet that accounts for the different learning contexts as described by Falk and Dierking was hypothesized (see Table 3).

Table 3.

The museum worksheet experience as related to the Contextual Model of Learning

Characteristic	Suggestions based on model	Worksheet style
Task density	*Motivation and expectations; Prior interest; Orientation cues*: Visit should include time to address visitor needs to "explore all" as well as allow time for orientation and novelty effects. This limits time devoted to more specific learning goals.	Worksheet has high T/H and T/Q; There are fewer questions and fewer exhibits examined by use of the worksheet.
Orientation cues	*Orientation*: Teacher must actively address site novelty and possibly sensory overload.	Orientation cues are incorporated into the worksheet, without providing too rigid of structure. Most orientation should take place before and at the start of the visit.
Information source	*Expectations; Design*: Learning in museums is conceptualized concretely, based on direct experiences with objects and exhibits. Visit should focus student attention on that which is unique to the informal setting and unavailable in the classroom.	Worksheet responses are based on objects and displays rather than text; the worksheet emphasizes that which would be difficult to experience in the classroom.
Level of choice	*Choice and control; Prior interest*: Choice provides for a positive attitude and allows for recognition of individual prior knowledge and interests.	Worksheet allows student some choice in what information is sought.
Cognitive level	*Prior knowledge; Within-group social mediation*: Variation accounts for differences in student experience and expertise. Also allows for social interaction and scaffolded learning.	Worksheet incorporates both low and higher levels of questions. Also encourages students to work cooperatively.
Response format	*Prior knowledge; Within-group social mediation*: A variety of response modes addresses different learning styles and can promote social interaction.	Worksheet includes all formats of response—verbal and nonverbal, written and unwritten.
Worksheet rationale	*Advance organizer; Within-group social mediation; Reinforcing experiences*: Worksheet may serve to organize the visit for more meaningful understanding, especially if related to in-school learning. Can also promote student learning in a social context unlike that within the classroom.	Worksheets make clear connections between exhibits and classroom topics and provide just enough order to assist meaning-making; worksheets are shared, requiring students to discover answers as a team.
Classroom connection	*Reinforcing experiences*: Museum experience is made more meaningful through connections to prior knowledge and memory. Elaboration facilitates the storage and retrieval of long-term memories.	Worksheet is used after visit to promote discussion and lead to additional activities.

Note that the worksheet proposed here is more closely related to the concept agenda defined earlier, as it shares some of the same dimensions of characteristics (task density, orientation cues, information sources, centeredness, classroom connection). Thus although there were no direct measures of learning in this study, it seems more likely that the concept agenda worksheet would contribute to a more meaningful learning experience than the survey agenda when examined in terms of the Contextual Model (Falk & Dierking, 2000).

Other Influences

Once students receive the worksheet, there are additional external factors, including teachers, chaperones, and even overall crowding, that clearly influence how the worksheet is used and how it contributes to the student's learning experience. For instance, observations of different groups from the same schools showed that students could have vastly different experiences with the same worksheet, depending on the support of the accompanying adult. On one occasion, a teacher was able to make a very museum-centered worksheet more student-centered using appropriate questions and allowing students to explore items beyond the worksheet. Meanwhile, a group of their classmates were being moved from exhibit to exhibit, answer to answer, by inexperienced, but ultimately good-intentioned chaperones. Despite similar materials, the adult's interpretation of what should be happening had a significant influence on the students' experiences.

Implications

Looking more closely at museum worksheets and how they are used during a field trip provides valuable information about teacher strategies for using these institutions to create a learning experience. In this investigation, format and content of worksheets varied according to the teacher's agenda for the trip; in most of the cases examined here, that agenda was expressed as a museum overview or survey. In these cases of survey agenda, students were limited in their time allotted for each exhibit hall, and the choices (and control) they had in taking charge of their own learning. In addition, for almost all groups in both agenda types, there was limited connection with classroom curriculum, before or after the visit, contrary to the many recommendations in the museum research literature that promote pre- and post-visit activities.

All of these teachers set out to create a good learning experience for their students. The fact that they made the extra effort to develop a worksheet and familiarize themselves with the museum is evidence of that. As students were not assessed regarding their knowledge, before or after the experience, it is only possible to speculate as to which experiences were more likely to contribute to student learning. Examination of the museum worksheets and visits through the lens of the Contextual Model of Learning suggests that teachers who adopt a concept agenda and corresponding worksheet are more likely to create experiences conducive to student learning. Although teachers and students may feel the need to see everything

in the museum, it seems unlikely that this worksheet-guided survey approach, with its high task density and limited elaboration following the visit, would produce meaningful learning outcomes that would enhance the teacher's classroom curriculum and the students' formal learning. This is not to say that this survey agenda experience would not lead students to develop any new understanding, or produce other social or affective outcomes. As mentioned, social context is an important part of museum memories. Perhaps teachers interviewed felt obligated to describe their visit plans in terms of learning outcomes when they really just wanted to expose students to the culture of museums. This may be a valuable goal in itself. Yet it would seem that a goal such as this could be achieved without the use of elaborate worksheets. And in a school culture of increased accountability of learning and justification of educational approach, it seems more likely that at some level, these teachers viewed these field trip experiences as opportunities for learning content.

The teacher behaviors and attitudes observed here indicate that there is some uncertainty as to how to best utilize the museum setting to create a learning experience. Teachers mentioned the need for structure and control (represented by the worksheets) if learning was to occur. However, this is not necessarily a question of poor practice, but rather inappropriate strategies. The heavy dependence on written text as a source of information and the need for classroom control are attributes often shared by well-intentioned novice teachers. Studies of self-efficacy indicate that it is situated (Ramey-Gassert & Shroyer, 1992), thus teachers who are confident in their abilities to affect student learning in the classroom may not be as confident in the museum setting. Perhaps we need to look at teachers in museums as well-intentioned novices who are using prior museum experience, perhaps from when they were a student, to inform practice. Studies of novice teachers have shown that they often rely on their preconceived beliefs of what teaching is, based on prior experiences (Calderhead & Robson, 1991; Hoy & Murphy, 2001). If a related phenomenon is occurring on field trips, museum educators are left with the responsibility of mentoring these teachers to help them create new experiences that meet their needs.

More study is needed to determine how the museum experience might be optimized for school groups. The next step might involve development of model worksheets that are more student-centered and emphasize a concept agenda, based on suggestions from Table 3. Because the teacher plays a significant role in guiding the overall experience, museum educators would also need to improve communication with schoolteachers to help them understand the unique setting and opportunities that museums and similar institutions provide. Training teachers to think differently about field trips will go a long way toward improving their educational benefits. Although teacher inservices may be helpful, introducing these concepts to preservice teachers might prove even more beneficial. Unfortunately, this may involve adding to an already full teacher preparation program. Regardless of approach, the museum must take an active role if these outcomes are to be achieved. In a sense, the "burden of proof" lies with the informal learning institution in showing how exhibits and collections can enhance

student learning and, more importantly, in convincing administrators and teachers that a field trip is worth the effort.

Creating an effective learning experience in a museum is more than creating an effective worksheet. Teacher, student, and especially museum must all be prepared to contribute to this goal.

While some researchers dismiss the use of worksheets as interfering with the student's ability to observe and create his or her own questions, it seems that worksheets, if properly developed with a concept agenda and an eye toward the reality of the museum setting, may help teachers bridge the gap between structured classroom learning and learning in an informal environment.

Notes to Table 1

[1]In cases when lunch was included as part of total time, 30 minutes were subtracted from the total to reflect total time spent in the museum.

[2]A total time of 30 minutes was used for this calculation, reflecting the time spent in the hall where questions could be answered.

[3]In cases where exact time was not known, an average time of 2 hours was assumed, based on information from the school tour coordinator.

[4]No observations or interviews were conducted for these schools; worksheets were the primary source of information.

[5]In this case, the total number of main exhibit halls was assumed, as the teacher stated this as a goal.

References

Ausubel, D. (1977). The facilitation of meaningful verbal learning in the classroom. *Educational Psychologist, 12*, 162-178.

Bitgood, S. (1994). What do we know about school field trips? In *What research says about learning in science museums* (Vol. 2). Washington, D.C.: Association of Science-Technology Centers.

Bloom, B. S., Engelhart, M. D., Frost, E. J., Hill, W. H., & Krathwohl, D. R. (1956). *Taxonomy of educational objectives. Handbook I: Cognitive domain.* New York: David McKay.

Calderhead, J., & Robson, M. (1991). Images of teaching: Student teachers' early conceptions of classroom practice. *Teaching and Teacher Education, 7*, 1-8.

Canizales de Andrade, R. (1989). *Comparisons of learning from structured and nonstructured visits to a science exhibit.* Unpublished Ph. D. Dissertation, Western Michigan University, Kalamazoo, Michigan.

Canter, D. (1991). Understanding, assessing and acting in places: Is an integrative framework possible? In T. Garling & G. H. Evans (Eds.), *Environment, cognition and action: An integrated approach* (pp. 191-209). New York: Oxford University Press.

Falk, J. H., & Dierking, L. D. (1992). *The museum experience.* Washington, D.C: Whalesback Books.

Falk, J. H., & Dierking, L. D. (1997). School field trips: Assessing their long-term impact. *Curator, 40,* 211-218.

Falk, J. H., & Dierking, L. D. (2000). *Learning from museums: Visitor experiences and the making of meaning.* Walnut Creek, CA: Altamira Press.

Falk, J. H., Moussouri, T., & Coulson, D. (1998). The effect of visitors' agendas on museum learning. *Curator, 41,* 107-120.

Fivush, R., Hudson, J., & Nelson, K. (1984). Children's long-term memory for a novel event: An exploratory study. *Merrill-Palmer Quarterly, 30*(2), 303-316.

Fry, H. (1987). Worksheets as museum learning devices. *Museums Journal, 86,* 219-225.

Gennaro, E. D. (1981). The effectiveness of using previsit instructional materials on learning for a museum field trip experience. *Journal of Research in Science Teaching, 18*(3), 275-279.

Griffin, J. (1999, March). *An exploration of learning in informal settings.* Paper presented at the National Association for Research in Science Teaching Annual Conference, Boston, MA.

Griffin, J., & Symington, D. (1997). Moving from task-oriented to learning oriented strategies on school excursions to museums. *Science Education, 81,* 763-779.

Hoy, A. W., & Murphy, P. K. (2001). Teaching educational psychology to the implicit mind. In B. Torff & R. J. Sternberg (Eds.), *Understanding and teaching the intuitive mind: Student and teacher learning* (pp. 145-185). Mahwah, NJ: Lawrence Earlbaum Associates.

McManus, P. M. (1985). Worksheet-induced behavior in the British Museum. *Journal of Biological Education, 19,* 237-242.

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.

Price, S., & Hein, G. (1991). More than a field trip: science programmes for elementary school groups at museums. *International Journal of Science Education, 13,* 505-519.

Ramey-Gassert, L., & Shroyer, M. G. (1992). Enhancing science teaching efficacy in preservice elementary teachers. *Journal of Elementary Science Education, 4*(1), 26-34.

Ramey-Gassert, L., Walberg III, H. J., & Walberg, H. J. (1994). Reexamining connections: Museums as science learning environments. *Science Education, 78,* 345-363.

Rennie, L., & McClafferty, T. (1995). Using visits to interactive science and technology centers, museums, aquaria, and zoos to promote learning in science. *Journal of Science Teacher Education, 6*(4), 175-185.

Tuckey, C. (1992). Schoolchildren's reactions to an interactive science center. *Curator, 35,* 28-38.