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Abstract

Exhibits are among the oldest educational media still in wide use today, and they continue to serve a particularly important role in a range of Extension and nonformal science communication settings. While agricultural and applied communicators have an established tradition of evaluating various information channels and media, there is very little published work in the discipline that describes procedures for measuring the performance or impact of educational exhibits. Evaluation is often complicated by the placement of educational exhibits in unique venues such as fairs and shopping malls that may not lend themselves to conventional research procedures or learning metrics associated with formal education settings. This professional development paper draws from the free-choice learning literature to describe some of the special challenges that can arise in the evaluation of educational exhibits. The authors then introduce an evaluation strategy used successfully in measuring the impact and effectiveness of multiple educational exhibits over a four-year span. Developed largely from the museum-studies literature and replicated through evaluations with several exhibits, the mixed-methods strategy described here can be tailored to meet applied communicators' specialized evaluation needs and resources. Following a discussion of this approach, the authors draw on their collective experience in sharing 10 practical steps to help frame the essential phases of a successful exhibit evaluation process.

Keywords

Exhibits, agricultural, ree-choice, educational, information, communications technology

Professional Development

An Approach to Measuring the Impact and Effectiveness of Educational Science Exhibits

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Abstract

Exhibits are among the oldest educational media still in wide use today, and they continue to serve a particularly important role in a range of Extension and nonformal science communication settings. While agricultural and applied communicators have an established tradition of evaluating various information channels and media, there is very little published work in the discipline that describes procedures for measuring the performance or impact of educational exhibits. Evaluation is often complicated by the placement of educational exhibits in unique venues such as fairs and shopping malls that may not lend themselves to conventional research procedures or learning metrics associated with formal education settings. This professional development paper draws from the free-choice learning literature to describe some of the special challenges that can arise in the evaluation of educational exhibits. The authors then introduce an evaluation strategy used successfully in measuring the impact and effectiveness of multiple educational exhibits over a four-year span. Developed largely from the museum-studies literature and replicated through evaluations with several exhibits, the mixed-methods strategy described here can be tailored to meet applied communicators' specialized evaluation needs and resources. Following a discussion of this approach, the authors draw on their collective experience in sharing 10 practical steps to help frame the essential phases of a successful exhibit evaluation process.

Introduction

Exhibits are among the most versatile educational media used in promoting science communication today, reaching thousands of youth and adults in a diverse range of venues that may include schools, fairs, shopping malls, museums, science centers, and other settings (Caulton, 1998). Owing to advances in materials construction and communications technology, modern educational exhibits are increasingly lightweight and durable, and they offer options for multimedia capability, computer games, and other interactive features (Macdonald, 2011; Lorenc, Skolnick, & Berger, 2007).

Although widely used in communicating science and technical information to various audiences, educational exhibits have received very little attention in the agricultural and applied communications literature, particularly in terms of measuring their educational impact or effectiveness. This void in the literature is surprising, given the expertise and resources required to develop professional-quality exhibits as well as the discipline's tradition of critically assessing print, electronic and emerging communications media (Rhoades and Hall, 2007; Fannin, 2006; Fannin & Chenault, 2005; Wood-Turley & Tucker, 2003; Rhodenbaugh, Holcombe & Hartman, 2003; Irani, 2000; Boone, Meisenbach & Tucker, 2000; Suvedi, Campo & Lapinski, 1999).

The bulk of published research on developing and evaluating educational exhibits has been conducted primarily by science center and museum professionals whose work dates back 100 years (Hein, 1998; Bitgood, Serrell & Thompson, 1994; Miles, 1988). More recent research in this area can be accessed through a specialized field of scholarship known as free-choice learning, which involves informal learning activities initiated by and under the control of the individual learner (Falk, 2001; Martin, 2001). The concept of free-choice learning is particularly relevant when one considers the learning environment in which most educational exhibits are placed. Exhibits are typically designed with the expressed goal of attracting or luring visitors who are in charge of and actively participate in their own learning experience (Simon, 2010).

This professional development paper provides a compact overview of educational exhibits in the free-choice learning environment, followed by description of a mixed-methods approach recommended by the authors in evaluating the effectiveness of educational exhibits. The authors developed an initial exhibit evaluation approach following a review of the free-choice learning and exhibit evaluation literature. The methodological approach was successively improved by the evaluation team in assessing multiple exhibits over a four-year span. This paper describes the exhibit evaluation approach resulting from this iterative process and concludes with practical guidelines for applied communicators in tailoring an approach for their particular needs.

Educational Exhibits and the Free-Choice Learning Environment

Dating back more than a century, educational exhibits are among the oldest communication products of Land-grant universities (NPAC, 1960). Although not appropriate or practical in every educational venue or for every audience, educational exhibits have endured because of the unique experiences they can offer to visitors. Exhibits often provide textual information, but they are designed to be more than "books on walls" (Leinhardt & Knutson, 2004, p. 125). Modern exhibits can offer a multisensory environment that includes large color photos and artwork, special lighting, audio scripts, video panels, and computer games. They may offer the capability to publicly and securely display rare or unusual specimens or artifacts for public viewing and enjoyment. Importantly, visitors can often physically touch and interact with the exhibit through the incorporation of touchpads, keyboards and other special features.

Much of the literature on the history and best practices surrounding educational exhibits is located in a specialized field of education known as free-choice learning. Falk and Dierking (2000) define free-choice learning as a special type of learning in which the pupil rather than the instructor controls the learning process, including when, what, how, and how long he or she will engage in a learning experience. Compared to the more structured learning mode of the classroom, free-choice learning has been described as more of a nonlinear process that typically occurs over short periods of time and requires no prior knowledge (Bamberger & Tal, 2007). While free-choice learning is often associated with informal learning in museums and science centers, the actual range of venues is unlimited (Martin, 2001). It is a spontaneous type of learning that takes place anywhere individuals can freely access media such as books, radio and the Internet. Falk (2001) acknowledges that while formal education systems are critical to the well-being of society, individuals can and do learn much about the world and about science through a wide range of informal learning environments such as zoos, nature centers and community organizations. He calls for increased research on these venues and on educational media as potential resources to support lifelong free-choice learning.

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While many communication products and media can at times be instruments in free-choice learning, educational exhibits are nearly always used in environments where the learner, not the educator, controls the learning environment. Compared to other Land-grant communication products, educational exhibits are unique in several other aspects:

- As with all educational media, exhibits must be well-designed and interesting, but unlike publications or Web sites, they cannot be saved or bookmarked for later reading or reference.
- An effectively designed educational exhibit must be capable of attracting a visitor's attention from a distance, appealing to his or her senses, and drawing that individual into a physical space that creates wonder and curiosity.
- Visitors must literally think on their feet because exhibit learning spaces are often walkways or corridors. Learning occurs as ambulatory visitors browse and move through an exhibit area.
- Individuals nearly always visit exhibits in groups, which offers potential benefits to learning because of the opportunity to ask questions, share thoughts, and discuss subject matter. Dis advantages include possible distractions to the learning process as adults watch children or carry on conversations unrelated to the exhibit.
- While they hold the potential to reach hundreds or even thousands of people, educational exhibits are not properly thought of as mass media, and there is not a well-established Land-grant tradition in assessing their performance.

Research on free-choice learning has identified a number of interesting facets relevant to applied communicators who use exhibits as educational media. Much of this work is associated with Professor John Falk of Oregon State University, whose publications represent an excellent starting point for those interested in learning more about free-choice learning (see references cited in this paper for more information). Following is a sampling of such insights:

- As additional exhibits are added in a learning space, visitors tend to look at more of them, but total time spent in the exhibit area does not increase (Hein, 1998).
- Exhibits that face each other often compete for attention, as research shows that visitors tend not to zig zag between exhibits (Bitgood, Serrell & Thompson, 1994).
- Visitors exiting an exhibit typically cannot articulate what they think they have learned. Re searchers recommend that evaluators attempting to measure learning simply ask visitors to describe in their own words the main point or the major message of the exhibit (Falk & Di erking, 2000).
- In quantitative studies conducted to identify factors associated with visitor learning through exhibits, common education variables such as prior knowledge, motivation, and interest ex plained no more than 9 percent of the variance in learning (Falk, 2004).

Studies of exhibit visitors are unique in applied communications because they typically involve studying actual environments where learning and interaction are taking place. The live exhibit setting creates both opportunities and challenges for applied communication professionals in evaluating the educational performance of an exhibit. Opportunities arise from the authentic learning laboratory that presents itself as visitors candidly interact with exhibits – the spontaneous human interaction and learning that take place naturally in the exhibit cannot be simulated in a laboratory. The exhibit area is, therefore, an attractive venue to measure attitudes, observe unrehearsed behaviors, and, in general, "eavesdrop" on the learning process with actual visitors.

However, practical and methodological challenges also quickly arise in the free-choice learning environment. For example, it is important to recall the fact that randomness is one of the most powerful concepts in social science research. Through random sampling, researchers are able to study smaller groups (samples) of individuals or things and make generalizations to larger groups. This is the reasoning behind public opinion polls and political election surveys that can accurately predict the attitudes or behaviors of thousands or hundreds of thousands of people based on only a few hundred responses. Generalizations can be made to a larger population only if the assumption of randomness is satisfied during sampling.

A major issue in many free-choice learning environments is that individuals who voluntarily attend museums or fairs to visit exhibits cannot be considered to be randomly assigned to this experience from the larger population. In other words, exhibit visitors may well differ from the general population and, importantly, from others who choose not to visit exhibits, but we usually do not know specifically how they differ. In short, we generally must assume that exhibit visitors who voluntarily view an exhibit may be part of a special population for which we have limited information (Crane, 1994). In those cases, we cannot assume they are randomly assigned from the general population. Results from visitor surveys, interviews, or observations must be interpreted and used with caution and typically do not lend themselves to generalizations about much larger populations such as 12- to 14-year-olds with an interest in science or single moms with limited knowledge of food safety.

Challenges also confront evaluators in using experimental design methods to measure learning from an exhibit experience. For example, consider a scenario in which an evaluator intercepts individuals directly before they enter the exhibit, administers a pre-test, and then tests the same individuals again as they exit. Presumably, any differences in paired-sample t-testing between pre- and post-test scores could be attributed at least partially to learning that has occurred in the exhibit. Challenges arising from this research approach include potentially low rates of participation from visitors who do not wish to sacrifice their leisure time by taking multiple "tests." Because the majority of people visiting fair and museum exhibits do so in groups with family and friends (Hein, 1998), asking one individual to participate in the research inconveniences the whole group. Another potential threat to data quality is that asking individuals to participate in a pre-test potentially contaminates the exhibit experience under consideration. The phenomenon is reminiscent of the well-known Hawthorne effect, documented as far back as the 1930s, that showed individuals often behave differently if they sense they are being observed or studied. In the case of an exhibit evaluation, such an effect could alter the spontaneous learning experience that researchers are attempting to study.

Arriving at an Evaluation Solution

Despite some of the evaluation dilemmas presented by free-choice learning environments, it usually is possible to develop a research strategy to help guide practical decision-making for formative and summative exhibit evaluation purposes. Developing an appropriate evaluation strategy is all about finding the right fit for each situation that is influenced by budgets, deadlines, available personnel, and uses of the data. In formative evaluations undertaken to help fine-tune an exhibit for a particular target audience, evaluators may be able to glean useful information from observing or interviewing even a small number of visitors as they interact with the exhibit. Formative evaluations

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are extremely important in making ongoing improvements over the life of a project (Crane, 1994). In summative evaluations or those needed to help inform significant decisions about future funding or activities, data requirements may well be more rigorous. In such cases, it may be advisable to collect different types of data from a larger number of visitors and to do so at several points in time.

Our approach. At Purdue University, the professionals who develop and fabricate exhibits are housed in the Exhibit Design Center, a 15,000-square-foot facility that offers studio space and specialized equipment for CAD engineering, cabinet-making, metalwork, plastic fabrication, modeling, construction, and prototyping. As a component of the Department of Agricultural Communication in the College of Agriculture (see http://www.ag.purdue.edu/agcomm/), the Center draws upon expertise of the unit's writers, editors, videographers, and graphic designers in developing exhibits and interactive elements.

The Center specializes in the development of two- and three-dimensional learning environments that provide informal science education and promote science literacy to local, state and national audiences. The cost of exhibits produced by the Center varies widely and can range from approximately $2,000 to $500,000 depending on size (square feet), use of hands-on and interactive elements, electronic technology and digital components, and special effects elements. Smaller exhibits are typically funded by Cooperative Extension while larger projects tend to be funded by faculty research grants.

Evaluation has been an integral part of the Center's development and design process since 2004. The Center's staff members are information design specialists who analyze audiences, develop learning objectives, and collect evaluation data for educational exhibits they create. In 2006, the Center's coordinator formed an evaluation team to focus on a particular exhibit developed in the previous year – a 500-square-foot multimedia exhibit titled "Nano in Your Neighborhood" focused on nanotechnology education (Figure 1).

Figure 1. "Nano in Your Neighborhood" Exhibit at the Indiana State Museum

The evaluation team included exhibit designers and writers, as well as a faculty member and graduate students from the academic Agricultural Communication Program. The team set up regular meetings to discuss data needs, resources and steps required to launch an evaluation program. A literature review was undertaken to learn more about exhibit evaluation methodologies that have been used in the free-choice learning environment. Figure 2 provides a listing and short description of some of the most common evaluation methodologies discovered through this process.

Figure 2. Common Evaluation Methodologies Used in the Free-Choice Learning Environment

- ❑ **Meso-genetic method:** Keeping of detailed notes to document the evolution of the exhibit through its various life phases. Ongoing notes are made in response to content and design changes in the exhibit as well as their consequences, much like a journal or diary.
- ❑ **Visitor observation:** Visitors' routes are tracked through the exhibit and recorded on special maps, along with information such as time spent in the exhibit, interaction with the exhibit, and obvious visitor characteristics such as sex, approximate age, and presence of children or other adults in the group.
- ❑ **Survey techniques:** Survey strategies can include comment cards or questionnaires in which visitors provide written responses to questions about the exhibit, levels of interest in the subject, and possible future behaviors. Demographic variables such as sex, age, and level of education are also included.
- ❑ **Experimental designs:** An evaluation method that typically involves testing of subjects' knowledge or awareness before and at one or more points after exposure to an exhibit or other treatment. Differences in pre- and post-test measures are attributed to the treatment. Considered by some as the "gold standard" in educational research in prior decades.
- ❑ **Interviews:** Personal interviews involve brief "conversations" with visitors about their exhibit experience, overall impressions and various demographic characteristics. A structured or semi-structured questionnaire is often used as visitors exit the exhibit area.

Note: See Hein (1998) and Martin (2001) for more information on the use of these methodologies in exhibit evaluation.

The evaluation team discussed the advantages and disadvantages of the methodologies shown in Figure 1 in light of data needs, budget and timelines associated with the nanotechnology exhibit. Ultimately, the group decided to focus primarily on two of the strategies – visitor observations and interviews with individuals 18 or older (Yalowitz & Bronnenkant, 2009; Falk & Storksdieck, 2005). As the group met and discussed evaluation options over several weeks, the following mixed-methods design began to emerge:

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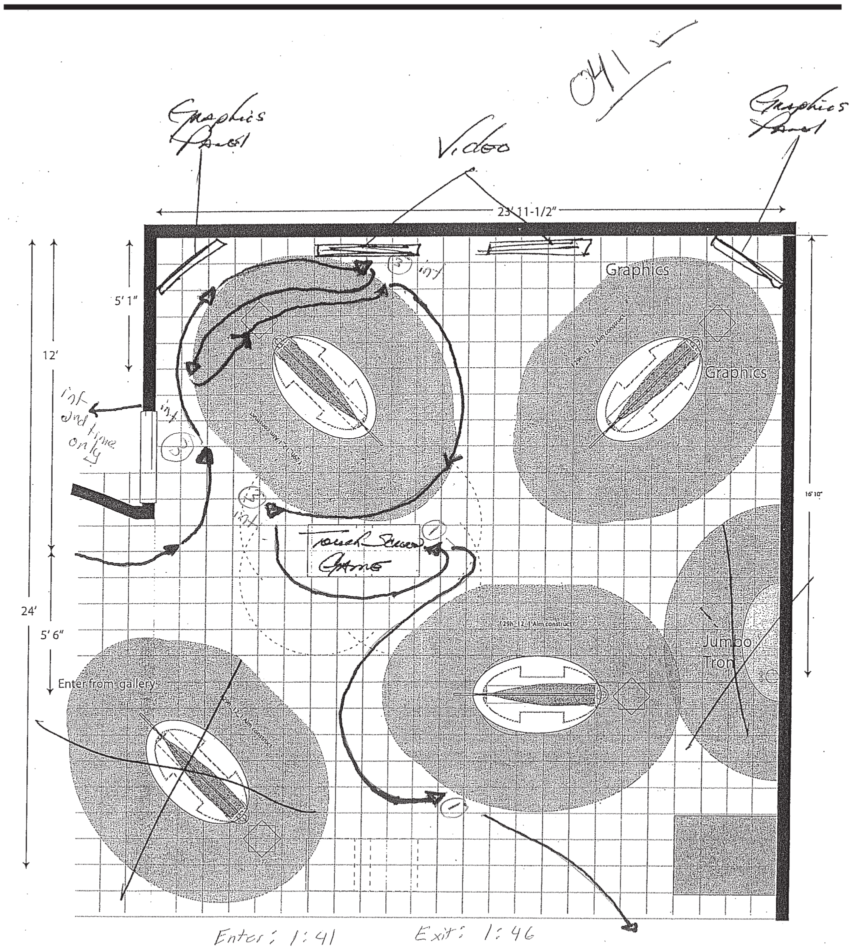
Visitor observations. Up to three evaluation team members agreed to participate in data collection on specified days. Generally, one individual took responsibility for observing and tracking visitors throughout the project. Early experimentation showed that one team member assigned to observations was preferable to having two persons on any given day because one individual could randomly select and track visitors without the need to coordinate with a second person. Having one person take responsibility for observations also simplified the training task and assured that data were collected in a uniform manner. The team member who performed the observations stood near the exhibit entrance with a clipboard, a stopwatch, and detailed maps for recording visitor paths.

The data collector observed and tracked visitors' paths through the exhibit on floor plan maps similar to the example shown in Figure 3. In addition, the data collector tracked the overall amount of time a visitor was in the exhibit, sequence and duration of each stop in the exhibit area, and the level of interaction visitors displayed with: 1) family, friends or other visitors, and 2) the exhibit itself. While the data collector tried to be unobtrusive and stay out of visitors' way, no attempt was made to conceal activities. The individual wore a polo shirt with the university colors and logo and a name tag that identified him or her as a member of the exhibit staff.

Figure 3. Replica of Map Used to Trace Visitor Paths through "Nano in Your Neighborhood" Exhibit



Interviews. Our research strategy also called for up to two individuals to conduct personal interviews with visitors. Experience showed that two interviewers worked effectively in maximizing data collection. These individuals were positioned outside the exhibit to randomly intercept visitors as they exited the exhibit area. However, because our sampling plan required that visitors be in the exhibit for at least 30 seconds, it was important that interviewers be able to see visitors entering the exhibit, as well. Once a visitor was selected by the interviewer, our plan called for interviewers to approach the visitor with a friendly introduction, request the visitor's participation in a short interview, and offer a small incentive for their participation. Following is an excerpt from the script we used to recruit visitors:

> Hi. We hope you're enjoying your time at the fair today. I'm <your name> from Purdue University and we're trying to learn what people think of this exhibit so we can improve it before taking it on a national tour. Are you willing to help us by answering a few questions about the exhibit for us? This will take about five minutes, and we can give you a bottled water in return for your participation.

While the bottled water incentive offered to visitors was modest, it served well as an icebreaker and visitors reacted positively. Our rate of interview participation has ranged from approximately 65 percent to 85 percent of visitors across several evaluation projects. While particular interview questions vary according to the exhibit being evaluated, a core set of questions and demographic items has been used in all the evaluations. Sample core items included the following:

- Why did you come through this exhibit today?
- What do you think is the overall message of this exhibit?
- After viewing this exhibit, how would you describe your level of interest in [exhibit topic] (Scale: 1, could care less; 6, so interested you can't get enough)?
- What did you like most about the exhibit? Why?
- What did you like least about the exhibit? Why?
- On a scale of 1 to 5, how would you rate the overall exhibit? (Scale: 1, very dull; 3, average; 5, very fun and interesting?)

The exhibit evaluation methodology described here was replicated with several exhibits over a four-year period. Findings from this work have been indispensable in improving the design and performance of our educational science exhibits in specific ways. For example, visitor tracking data from the "Nano in Your Neighborhood" exhibit revealed traffic flow difficulties that were corrected by changing the location of two electronic game kiosks. Observation and interview data also revealed that text on the exhibit's introduction panel needed clarification. These and other findings, along with measures taken to ensure instrument validity and reliability, have been shared in previous conference presentations (Rhoades, Tucker & Sigurdson, 2009; Tucker, Huerta & Bricker, 2007) and will be published in a future *JAC* article now in progress. The instrumentation used in these projects is available from the authors upon request.

Another valuable byproduct of our work during the past several years is an improved overall exhibit development process. As a result, we have identified 10 major steps that describe and inform

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the various phases of a successful exhibit evaluation process. These steps, shown in Figure 4 and discussed below, can be used by others in launching similar educational exhibit evaluation efforts in free-choice learning environments.

Figure 4. Recommended Steps in Exhibit Evaluation

1. Develop learning objectives.
2. Identify resources and personnel.
3. Develop instrumentation.
4. Work out methodological details.
5. Seek human subjects approval.
6. Train evaluation team members.
7. Develop a data collection schedule.
8. Collect and analyze data.
9. Share findings with stakeholders.
10. Convene design and evaluation teams.

Steps to Successful Exhibit Evaluation

1. Develop learning objectives. Identifying a manageable number of learning objectives is one of the most important tasks to accomplish at the outset of the project. Coming to agreement on specific learning objectives you have in mind for exhibit visitors is essential not only to the evaluation process, but to the success of the exhibit in general. Think in terms of three to four tightly written statements that specify the learning goals you want visitors to be able to accomplish after experiencing your exhibit. Once written, these objectives should guide development of the exhibit and the evaluation.

2. Identify evaluation resources and personnel. Early in the project, identify an individual who will provide leadership for the evaluation process. This person will lead the group in developing the evaluation methodology and instrumentation, securing human subjects approval from the university, and addressing other relevant tasks listed in the following steps. If possible, select an individual who has no professional stake in the outcome of the evaluation. Such a person may be an Extension evaluation specialist or a faculty member in your college's agricultural communication or agricultural education program. Don't overlook qualified individuals in your own department, such as a staff member who has completed graduate course work in research methods. Serving in this role will require a significant time commitment, it offers publishing opportunities and the potential to learn more about alternative communication and education research methodologies.

3. Develop instrumentation. The questionnaires and other instrumentation you develop have a direct impact on the quality of your evaluation data. Your evaluation leader should help your group with the order, phrasing and number of the questions you ask. Experience has shown that most of us want to collect more data than we actually need. This impulse can result in lower participation rates and complicate data analysis. Ask only the questions you absolutely need and then think carefully about how items are phrased and ordered. In the case of tracking maps and related instrumentation, make sure they are large enough and of high enough resolution to use easily. Once instrumentation has been developed, perform a field test with a dozen or so individuals as a test to see if the instrumentation is adequate, easy to use and understandable both to your staff and to visitors. After field-testing, your instrumentation is ready to use.

4. Work out details and logistics. Because of its applied nature, evaluation research can be challenging and unpredictable. This is especially true in the free-choice learning environment, which may be in a museum, fair or shopping mall. Advance planning is essential to ensure that evaluation team members have the training and materials needed to start work promptly on the first day of data collection. Copies of instrumentation and questionnaires must be made available in a common area, along with clip boards, pens and any other needed materials. Instructions should be made available in hard copy to remind team members how to select research subjects, how to deal with refusals, and related matters. Team members also need a cell number or other instructions for reaching the team leader if questions arise. While such matters may seem mundane, they take on increased importance once data collection is under way. The primary goal during data collection is to maximize the amount of time spent interviewing and observing exhibit visitors. Poorly organized protocols rob the project of precious time and divert energy needed to collect quality data.

5. Seek IRB/Human Subjects approval. Generally, you are not required to secure human subject approval from your campus Institutional Review Board if you do not plan to publish your evaluation results. Therefore, evaluators may wish to skip this step for initial or very small-scale projects. Even in these cases, however, the evaluation team may wish to access the university IRB Web site for recommendations on ethical social science research practices. Especially valuable is advice on maintaining research subjects' confidentiality and right to privacy during and after data collection (Rennie & Johnston, 2004). Those who do wish to secure IRB approval should allow two to three weeks for this process; no phase of data collection or contact with the subjects can take place before approval is granted. Also keep in mind that all individuals who will have direct contact with exhibit visitors participating in the research should complete CITI (Collaborative Institutional Training Initiative) training on research ethics prior to submission of the IRB request. Consult your university's IRB Web site or IRB office for details.

6. Train evaluation team members. Before data collection, hold a special meeting to brief evaluation team members on the research process and procedures being used. For example, team members should use consistent phrasing when approaching research subjects. They should also administer questionnaires and code responses in a consistent manner. Such matters are critical in evaluation research because they directly influence the validity and reliability of the data. On days when data will be collected, it is helpful to have two to three trained team members available and ready to fulfill whatever roles are needed. As a part of the training process, the evaluation leader may choose to provide team members with a checklist such as that used by the authors and reproduced in Figure 5.

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Figure 5. Sample Checklist for Exhibit Evaluation Data Collection

General

- ❑ Pick up questionnaires and clip boards from front office.
- ❑ Wear university attire and nametag.
- ❑ Turn completed questionnaires in at the front office at the end of each day.

Interviews

- ❑ Randomly select individuals to complete interviews.
- ❑ Inform visitors that the interview takes only a few minutes; those who agree to be interviewed will receive a cold bottled water.
- ❑ Phrase all items as phrased on questionnaire; write responses as legibly as possible.
- ❑ Make note of any "interesting" observations.
- ❑ Write down exact words and expressions used by visitors. Use quotation marks for verbatim responses.

Tracking

- ❑ Track only those visitors who have been in the exhibit for at least 30 seconds.
- ❑ Make note of any "interesting" observations.

7. Develop a data collection schedule. As might be guessed from this discussion, data collection is one of the most crucial steps of the evaluation process. Unlike publications and other traditional media, exhibits are normally set up in particular venues for specified periods of time, ranging from days to months. Audiences of interest may have access to the exhibits only during limited periods. Consider, for example, the case where the evaluation team is interested in 11- to 12-year-old visitors to a science exhibit and it is learned that a school or youth organization will be visiting the exhibit on a particular day. In such a case, the evaluation team needs to be in a position to seek the necessary approvals to interview the youth and then be on location and ready when the group arrives. There may be only limited opportunities to access this population outside of this particular time. An important job of the evaluation leader is to use the team most efficiently to maximize the amount of quality data that can be collected. A hard copy or electronic sign-up sheet should be provided to team members in the days or even weeks before data collection to help determine which team members are available to collect data on each day, length of the work shifts, and related matters.

8. Collect and analyze data. After data collection, all completed questionnaires and instrumentation should be gathered by the evaluation team leader and prepared for data entry. We recommend entering data from the questionnaires into a software application such as Excel or SPSS so that it may be easily analyzed and stored. If the number of questionnaires is relatively small (1ess than 150 or so), one person can usually enter the data in a matter of a few days. It is important that data be

entered using a properly constructed coding sheet so that the data entry person knows how to handle special cases, such as incomplete questionnaires or missing data. Once the data are entered, the evaluation team leader should be able to generate basic descriptive findings in a matter of minutes to share with the group. The team leader should then work with the rest of the team to determine whether other analyses are needed, such as cross-tabulations or other techniques.

9. Write and share findings with relevant stakeholders. The evaluation process is not complete until all the findings and observations are assembled into a report. The evaluation report need not be publication-quality in the early stages. The main goal is to get findings in front of the exhibit design team and other stakeholders in a form that can lead to brainstorming and discussion. Ultimately, data should be presented in a final impact report that is suitable for sharing with stakeholders, administrators and others. Examples of reports developed by the authors are available upon request.

10. Convene design and evaluation teams to discuss findings and plan next steps. After results have been shared among team members, it is helpful to bring the evaluation team and exhibit staff together to discuss evaluation findings and next steps. Tasks to be accomplished at this meeting include identification of major evaluation findings, discussion of possible adjustments or improvements to the exhibit or exhibit floor plan, features of the evaluation that were especially helpful (or not), and needs for future evaluation. The leader should try to ensure that all team members feel comfortable airing their views and participating in a candid discussion of the research findings and evaluation process. At this stage, the group may also wish to discuss how and when evaluation results and recommendations will be shared with administrators or exhibit sponsors. If evaluation results are to be published, the group should discuss outlets for this work, authorship, deadlines and related matters.

Conclusions

Given the current importance of accountability and the need to measure impacts in higher education, applied communication professionals must increasingly build evaluation into their portfolio of professional services. A particular need exists to develop proven methods for evaluating educational science exhibits because of the significant time and expense required in their production. This professional development paper borrows from the free-choice learning literature and the authors' professional experiences to provide guidelines and recommendations for evaluating educational exhibits. Applied communicators can choose from a variety of different evaluation procedures. Evaluation teams should experiment to determine which procedures best meet their particular needs. Evaluation of exhibits, as with all communications media, must take into account the unique needs and resources of the department undertaking the research. The information shared here provides a starting place for those with limited experience in this area.

Among the key points stressed here is the fact that evaluation is not an ancillary activity but an integral part of the exhibit design process. When possible, evaluation personnel should be included in the initial and ongoing meetings of the exhibit design staff. All personnel must collaborate in the development of a manageable number of learning objectives that can be measured through evaluation. The time spent in assembling and training an evaluation team will pay dividends in terms of efficiency and quality data collection.

A critical phase of the exhibit evaluation process involves interpreting and using the findings. In an ideal world, evaluation results would clearly show that an exhibit has produced measurable and significant gains in learning and awareness in our target audience. Such results could then be used

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to justify additional resources for future work. In reality, unambiguous results of this nature seldom emerge based only on one evaluation. Multiple evaluations in different settings may be needed to provide the quality of data needed to document learning.

While Land-grant communicators have an established tradition of evaluating traditional and emerging media and audiences, the profession has little collective experience in studying the performance and impact of educational exhibits in the free-choice learning environment. Exhibit evaluation presents particular methodological challenges and often calls for novel and mixed research strategies to document learning – impacts from free-choice learning cannot be properly studied by simply importing learning objectives and metrics from formal education settings (Rennie & Johnston, 2004; Falk & Dierking, 2000). Evaluators must keep in mind the unique circumstances and limitations of free-choice learning when designing research and interpreting findings. Additional research is needed in this area.

In at least one important way, it is fitting that the literature and methodologies discussed in this paper have been borrowed largely from the museum research tradition. Museums began to appear in the 18th century in response to the notion that education and enlightenment should not be reserved only for the privileged and elite classes, but should also be attainable by working-class citizens. This is essentially the same notion that has sustained the Land-grant idea for 150 years. Although the call to develop expertise in exhibit evaluation and free-choice learning is based on practical needs, it serves a deeper purpose in educating and serving the public and, thus, advancing the Land-grant university mission.

About the Authors

Mark Tucker is professor and coordinator of the agricultural communication academic program in the Department of Youth Development and Agricultural Education, Purdue University. Jon Bricker is coordinator of the Exhibit Design Center, Department of Agricultural Communications, Purdue University. Alexandria Huerta is monitoring and evaluation team leader, USAID/Office of Agriculture, Kabul. She holds a doctoral degree in extension education from Purdue University. Earlier versions of this paper were presented at the 2009 international ACE-NETC conference, Des Moines, Iowa, and the 2007 annual meeting of the North American Colleges and Teachers of Agriculture, Champaign, Ill.

Keywords

Free-choice learning; educational exhibits; evaluation; mixed methods; science communication.

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