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**Assessing “Discover Mojave”
Instrument Development and Analysis**

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Abstract

We developed a comprehensive assessment plan and tested the curriculum to determine whether hands-on outdoor recreation events promote knowledge, attitudes, and performance among at-risk urban children. Knowledge, attitude, and performance assessments were developed, refined and conducted through various stages based on cultural and language barriers as well a variety of age groups participating within the events. Findings revealed that knowledge, attitudes, and performance increased substantially as a result of participating in the outdoor recreation events. We conclude that the implementation and assessment of the program is strong. We also make several recommendations for future programs.

Key Words: environmental education, assessment, attitude, knowledge, performance

Introduction

Background

Environmental Education Programs (EEP) have increased substantially over the last two decades. Developing valid assessment instruments for evaluating and improving these programs is essential. There is evidence from a variety of studies that informal learning experiences benefit student learning (Gerber, Cavallo, & Marek, 2001). Research also has considered the relationship between formal and informal learning in science (Wellington, 1990). Blending the two types of programs whenever possible appears to be a preferable strategy compared to maintaining separate formal and informal education systems. As a result, states and nations have begun to formulate integrated EEP within the broader context of national educational policies (Kadji-Beltran, 1999), curriculum documents (e.g. QCA, 1999), curriculum development initiatives (OECD, 1995), and conservation strategies (e.g. IUCN/UNEP/WWF, 1991). These efforts are a natural and logical progression in the ever-increasing bridge between formal and informal education. As development and evaluation of more EEP occurs, there is a need for “making sense of and critically analyzing the field of environmental education research” (Rickinson, 2001, pg 2). Data analysis also should be evidence-based, focusing on empirical evidence generated in the field (Rickinson, 2001).

The Public Lands Institute (PLI) at the University of Nevada, Las Vegas (UNLV) has created and managed an outdoor recreational learning program for southern Nevada children. Discover Mojave Outdoor World is a recreation program for urban, economically disadvantaged youth designed to introduce them to outdoor recreation, environmental education, fishing and boating, and aquatic resource management. The intent of this program is to encourage and facilitate lifelong recreation on public lands among lower socioeconomic, ethnically diverse school-age children. UNLV’s role is the implementation and administration of the program on behalf of the federal agencies that manage the public lands surrounding Clark County – Bureau of Land Management; National Park Service; U.S. Fish and Wildlife Service; and U.S. Forest Service.

At the request of the manager of the program, our research team became responsible for developing an assessment plan in order to document the effectiveness of program events over the duration of the program.

The purpose of this report is twofold:

- 1) to describe the development of various assessment instruments utilized to measure the effectiveness of the program initiatives. Assessment dimensions included specific and general attitudes, specific and general knowledge, and field-based measures of student performance, and,
- 2) to provide results of the analysis based on completed assessments.

Description of Program

Discover Mojave Outdoor World evolved as a pilot program based on the ideals found within the national Wonderful Outdoor World (WOW) program. The national program is based on the premise that participation in activities in natural settings impacts children in several ways: 1) provides a positive outlet for the alleviation of stress, 2) promotes physical exercise and activity, 3) stimulates an appreciation of and connection to nature, and 4) encourages the

responsible use of recreational areas. Providing recreational activities for children who lack such opportunities promotes equitable access and utilization of public recreational venues.

Public Lands Institute staff, including the project manager (Daphne Sewing) and the director of curriculum (Dr. Jeanne Klockow), developed five half-day events based on educational themes formed by an environmental educational committee comprised of federal agency and community members. The events were linked to these themes as broad-based outcomes for participants as a result of attending these events. The events were recreational in nature and comprised an educational component. The events were as follows: (1) Wetlands Bird Safari, (2) Fun with Fishing, (3) Kids in Kayaks, (4), Adventures in Art, and (5) Cool Canoeing. In addition, curricular modules created for each event correlated the events to content standards, life skills, technological sites and resources, and literature. The curricular modules divided events into three sessions; 1) an awareness session to set the baseline of knowledge, 2) an activity session and, 3) a debriefing session which served as the culminating activity.

Each event provided students with an opportunity to visit a local outdoor park or public land site. In the first event, children were taught how to bird watch at a local park and then transfer these skills to the local wetlands. The second event enabled children to participate in a “casting clinic” while learning about different kinds of fish and their habitats. In events three and five, children were given the opportunity to experience kayaking or canoeing at local parks. Event four utilized art and watercolors and other media to teach students about geological landforms and other phenomena. All events were designed with the student demographics in mind. Each event was meant to be transferable and accessible to the children that participated in them. Further, children were given “make and take” items to serve as a way of remembering the experience.

Method

Instrument Development

We began by meeting with the program staff of the Public Lands Institute to develop a sense of the kind of information that would enable us to evaluate the effectiveness of the program. We reviewed existing assessments in the literature such as the Environmental Sensitivity Questionnaire (Metzger & McEwen, 1999), The Survey of Environmental Issues Attitudes (Schindler, 1999), and The Children’s Attitudes Toward the Environment Scale (Musser & Diamond, 1999). Existing assessments were Likert-type instruments and consisted of items related to the affective domain as well as the cognitive domain. The assessment plan developed for the program was consistent with these existing assessments, in that we utilized Likert-type items to assess knowledge and attitudes. Because each event included an activity component, we felt that it was also important to include a performance assessment component. As Stiggins (2005) notes, observing and evaluating skills as they are being performed can be a rich and useful source of information about the attainment of specific skills.

We developed assessments for three areas of growth, including *knowledge*, *attitudes*, and *skill performance* for each of the five half-day events. Assessments for each of the five events included knowledge questions related to the specific event (e.g., *What did you learn about watching birds?*) and five attitude items (e.g., *I would like to show my friends how to watch birds*). The skill performance assessment, in the form of a checklist completed by the event

facilitator, measured whether or not the child demonstrated a particular skill (e.g., *Participant uses binoculars to find and focus on a bird*).

Implementation

The assessments were conducted over time (i.e., pre and post-intervention) to determine the effectiveness of these events in having an impact on student knowledge, attitudes, and performance about the environment. Participants for the events of Discover Mojave Outdoor World came from two sources. One source came from a drop-in program called the RecMobile, sponsored by Clark County's Parks and Community Services Department. A total of 44 children, aged eight through twelve, participated in four events over a period of three months (see Table 1 for a summary of RecMobile Events).

Another group of students came from an Environmental Science Club. Twenty-eight Grade 5 students from an at-risk professional development school, located in the east region of the school district, participated in the Discover Mojave events. A classroom presentation by the PLI Project Manager introduced fifth-grade students to the Environmental Science Club. This club served as the venue of access for students to the recreational events. Students were initially asked to complete an application in order to become a member of the Environmental Science Club. These applications asked such questions as, *Why do you want to be a member of this club? What do you like to study about science? Why do you think it is important for kids to learn about their environment?* Once student applications were complete and submitted, the students were divided into three groups: Roadrunners, Desert Tortoises, and Kit Foxes. The club meetings were organized by the PLI project manager and met after school to participate and plan for recreational events.

The assessment program included three data collection components:

- 1) the pre and post test measures of knowledge, attitudes, and skills
- 2) field journals completed by Environmental Science Club participants
- 3) individual and small group informal interviews conducted with participants at the conclusion of each event.

Three out of the five recreational events were conducted with the RecMobile participants and the Environmental Science Club participants. Each event provided student groups with an opportunity to visit a local environmental venue. In the first event, children were taught how to bird watch at a local park and then transfer these skills to the local wetlands. The second event enabled children to participate in a "casting clinic" while learning about different kinds of fish. The third event introduced and allowed children to experience canoeing at a local park.

In total, 13 recreational events involving 74 children were conducted and assessed. All participants completed the knowledge, skills, and attitude components of the assessment program. Interviews, occurring at the end of each event, were facilitated by PLI staff and conducted with RecMobile participants and Environmental Science Club participants. Participants from the Environmental Science Club also completed field journals. These journals, developed by the PLI staff, were intended to function as a more open-ended form of assessment.

Analysis

The knowledge measure, where students responded to open-ended questions, was analyzed using content analysis (Berg, 2001), in which student responses were coded in three categories (*no knowledge*, *partial knowledge*, and *more complete knowledge*). For example, when a student responded to the prompt “What do you know about canoeing” by writing “nothing,” this response was coded as *no knowledge*. An example of a student response that was coded as *more complete knowledge* in response to the prompt “What did you learn about canoeing?” was “I learned how to paddle and that the back person has more paddling to do. You have to work as a team. I learned how to be safe and wear a personal flotation device.” We calculated frequencies for the three knowledge categories (*no knowledge*, *partial knowledge*, and *more complete knowledge*) for all pre and post assessments (Tables 1 and 2).

Three different forms of analyses were completed for the attitude scales. For the RecMobile events, children were asked to respond to five statements that were specific to the activity. These attitude scales were summarized and frequencies were calculated for each of the five questions (Table 4). In addition to the event-specific scale, the children in the Environmental Science Club also responded to statements that were related to more general environmental themes.

The performance rubrics were summarized for each event by calculating how many of the participants demonstrated all skills, most skills, or some skills. Twenty-seven field journals were collected from the Environmental Science Club participants. However, none of the journals was fully completed, so an in-depth analysis was not undertaken. Fourteen individual and small group interviews were completed with RecMobile participants. These interviews, conducted and videotaped by PLI staff, did not follow a structured interview protocol. Participants were asked a variety of questions relating to knowledge, skills, and attitudes related to the particular event. Typical questions included the following: “Was there something you learned that you didn’t know before?” (knowledge); “Show me how you used the binoculars” (skill); and “Why do you think nature is important for the entire world?” (attitudes). Because the interviews were not conducted in a standardized way with respect to questions asked and the timing of the interview, an in-depth thematic analysis was not conducted. Rather, the videotaped interviews were viewed in order to gather evidence to further corroborate results from the knowledge, skills, and attitudes measures.

Results

Knowledge

Knowledge increased dramatically over the course of the children’s participation in the Discover Mojave events. For the RecMobile participants, 78% of student responses prior to participation indicated no knowledge. After participation, 96% of student responses demonstrated more complete knowledge. Similar results were found with the children in the Environmental Science Club: 30% of student responses prior to participation indicated no knowledge and, after participation, 75% of student responses demonstrated more complete knowledge. Combining results from both groups (see Table 3) shows that 44% of the children had little knowledge prior to the events compared to 78% having more complete knowledge after participating in the events.

The event that showed the largest overall increase between the pre and post tests of knowledge was canoeing. Prior to the event, children demonstrated very little background knowledge about canoeing. In response to the question, “What do you know about canoeing?” 35% of the children’s responses were coded as *no knowledge*. After the event, 88% of children responded to the question “What did you learn about canoeing?” with more complete knowledge. One child, for example, indicated on the pre-test that she knew that a “canoe goes in the water.” After the event, she explained that “I learned how to paddle and that the back person has more paddling to do. Being quiet is important. Wearing a lifejacket is helpful if you don’t know how to swim. You have to work as a team. Don’t pass the red things.”

Skills

The majority of participants (86% in the RecMobile group and 99% in the Environmental Science Club) demonstrated all performance skills. Five percent of the children demonstrated most of the expected skills, and only one child (1%) demonstrated some of the skills. One hundred percent of the children were able to demonstrate all of the skills associated with the canoeing event, and 95% demonstrated all the fishing skills. The event with the lowest number of children (90%) demonstrating all skills was the Wetlands Bird Safari.

Attitudes

Three different forms of analyses were completed for the attitude scales. The first consisted of attitudes based on RecMobile events in which children were asked to respond to five statements that were specific to the activity. Different children rated different events. Attitude scales were summarized and frequencies were calculated for each of the five questions (Table 4). Ninety-seven percent of the students involved in the RecMobile events strongly agreed or agreed with the positive attitude statements contained in the survey. Children were most positive about the fishing event (100% strongly agreeing or agreeing). The least positive attitudes were related to the canoeing event, where 18% indicated disagreement or strong disagreement, especially with respect to the statement “I would like to show my friends how to do the activity.” In a debriefing with PLI staff, it was discovered that event day conditions may have had an impact on attitudes. Because of high winds, several of the physically smaller children had difficulty paddling the canoes.

The second analysis was of pre-event and post-event attitudes from the Environmental Science Club. In addition to the event-specific scale, the children in the Environmental Science Club also responded to statements that were related to more general environmental themes. Children participated in all three events, although some children missed one of the three events on some occasions. Children made 4-point ratings on five questions; thus, scores ranged from 5 to 20, where 20 represented a very favorable attitude toward the event. Eighteen children had complete data for all three events. A 3 (type of event: Birding, Fishing, Canoeing) X 2 (time of event: pre, post) repeated measures analysis of variance was conducted on attitudes for specific events. Means and standard deviations are shown in Table 5. The main effect for event was significant, $F(2, 34) = 6.76, p < .01$. Attitudes for canoeing and fishing were higher than attitudes for birding, although all attitudes were very positive. In addition, there was a main effect for time, F

(1, 17) = 21.16, $p < .001$. Post-event attitudes were significantly higher than pre-event attitudes. The interaction between events and time was not statistically significant.

Results support three conclusions. First, in an absolute sense, attitudes were very favorable for all three events. Second, some events such as canoeing were rated as more favorable than other events such as birding. Third, attitudes became significantly more favorable after the event, suggesting that participation in the events had a positive impact on the children.

An identical analysis was conducted on general attitude data. Means and standard deviations appear in Table 6. The main effect for event was significant, $F(2, 34) = 4.48, p < .05$. This finding revealed that canoeing and fishing were rated as more favorable than birding. The effect for time and the interaction were not significant. Compared across specific and general attitudes, it is clear from Tables 5 and 6 that specific attitudes were more favorable than general attitudes. In addition, general attitudes did not change due to participation in the event, whereas specific attitudes increased significantly. Third, some events such as canoeing elicited more favorable attitudes than other events such as birding.

Summary

Overall, students' knowledge increased, they were able to demonstrate performance skills, and they had positive attitudes towards the environmental events in which they participated. Careful review of the videotapes showed that when interviewed, children's responses demonstrated knowledge, skills, and attitudes that corroborated findings from the assessment instruments. That is, children discussed in detail what they had learned and the skills they had acquired. Furthermore, their responses were overwhelmingly positive about the events. For example, when asked what she had seen during the birdwatching event, one of the children (Raquel) noted that she had seen a pintail, a mallard, a domestic goose, and a peacock. Related to her attitude toward the event in particular and the environment more generally, Raquel said, "It was a good experience. At home we stay inside basically. There's nothing to do. It's good to get outdoors."

Conclusions and Implications

The purpose of this research was to describe the assessment program, including the development of assessment instruments specifically for the purpose of documenting the effectiveness of Discover Mojave Outdoor World and to provide results from the first round of project implementation. Assessments were developed that were consistent with previous research in environmental education and that were consistent with best practices in educational assessment (Stiggins, 2005). We assessed knowledge, attitudes, and performance for each student. In addition, we collected interview and journal entries as a means to explore in more detail the experiences and learning of the children.

Two conclusions are supported. The first is that the assessments are comprehensive and capable of assessing different measures of growth from the beginning to the end of the program. The second conclusion is that the three events developed for the Discover Mojave program were highly effective based on growth from pre- to post-intervention assessments. Roughly 99% of children experienced substantial growth on skills and knowledge related to each event. Children also demonstrated strong positive attitudes about the experiences. Overall, results from the

assessments showed that program events have a significant and positive impact on children's knowledge, skills, and attitudes.

Recommendations

The following recommendations are offered as ideas to consider in order to further strengthen the assessment program.

1. Continuing assessment of Discover Mojave Outdoor World
2. Utilizing the knowledge and skills instruments that have been developed for Wetlands Bird Safari, Fun with Fishing, and Cool Canoeing. We do not see a need for further revisions of these instruments for the 2005-2006 school year. Assessments will need to be developed for the two events that were not assessed in the first phase of implementation (Kids in Kayaks and Adventures in Art).
3. Revising the timing of administering the general attitude instrument. Given that attitudes about general environmental issues did not change over the course of participation in the Environmental Science Club, we recommend eliminating these four questions from the pre and post attitude scales for each event. Instead, the general questions can be asked at the beginning of the program and at the end of the program.
4. Eliminating the field journals as an assessment tool and as a data source. Because none of the participants fully completed the journals they were not useful for assessment purposes. However, if PLI staff see the journals as an integral part of the event, they could be continued but not analyzed.
5. More carefully structuring the individual and small group interviews if they are to be used as a data source. We recommend the use of an interview protocol that eliminates global questions such as "Why is nature good?" The interviews should be conducted in a more standardized way. For example, the timing of the interview during the event needs to be more consistent. Interviewing children prior to the event should be discontinued, and interviews should take place at the conclusion of the event. The strategies of interviewing students in groups of two or three and interviewing students in the van during the ride back to the school seemed to be effective strategies that could be continued.
6. Additional data sources to be considered might include end of program interviews of parents, teachers, and the school principal. A teacher rating scale that measures the relationships between student participant in the Environmental Science Club and other outcomes should be developed.

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Table 1: Summary of RecMobile Events

Event	Participants	Knowledge - Pre			Knowledge - Post		Performance Skill Demonstration		
		None							
Wetlands Bird Safari 03/25/05	12	None	14/24	58%	0/24	0%	Some	1/12	8%
		Partial	8/24	33%	4/24	17%	Most	2/12	17%
		More Complete	0/24	0%	18/24	75%	All	9/12	75%
Wetlands Bird Safari 05/14/04	11	None	13/22	60%	2/22	9%	Some	0/11	0%
		Partial	9/22	41%	3/22	14%	Most	2/11	18%
		More Complete	0/22	0%	17/22	77%	All	9/11	82%
Canoeing 06/16/05	10	None	7/10	70%	0/10	0%	Some	0/10	0%
		Partial	3/10	30%	0/10	0%	Most	0/10	0%
		More Complete	0/10	0%	10/10	100%	All	10/10	100%
Fun With Fishing 04/19/05	11	None	18/22	82%	0/22	0%	Some	0/10	0%
		Partial	4/22	5%	3/22	14%	Most	1/11	9%
		More Complete	0/22	0%	19/22	86%	All	10/11	91%
TOTAL	44	None Complete	52/67	78%	1/67	1.5%	Some	1/44	2%
		Partial Complete	24/67	36%	10/67	15%	Most	5/44	11%
		More Complete	0/67	0%	64/67	96%	All	38/44	86%

Table 2: Summary of Environmental Science Club Events

Event	Participants	Knowledge - Pre			Knowledge - Post		Performance Skill Demonstration		
		None							
Wetlands Bird Safari 04/27/05 05/03/05 05/05/05	27	None	13/54	24%	2/54	4%	Some	0	0%
		Partial	41/54	76%	8/54	15%	Most	0	0%
		More Complete	0/54	0%	44/54	81%	All	27/27	100%
Fun with Fishing 05/17/05 05/19/05 06/01/05	26	None	21/52	40%	3/52	6%	Some	0	0%
		Partial	28/52	54%	16/52	31%	Most	1/26	4%
		More Complete	3/52	54%	33/52	63%	All	25/26	96%
Canoeing 05/11/05 05/26/05 05/31/05	24	None	5/24	21%	1/24	4%	Some	0	0%
		Partial	18/24	75%	3/24	13%	Most	0	0%
		More Complete	1/24	4%	20/24	83%	All	24/24	100%
TOTAL	77	None Complete	39/130	30%	6/130	5%	Some	0	0%
		Partial Complete	87/130	67%	30/130	23%	Most	1/77	1%
		More Complete	4/130	3%	97/130	75%	All	76/77	99%

Table 3: Summary of Combined Events

Event	Participants	Knowledge - Pre			Knowledge - Post		Performance Skill Demonstration		
		None							
Wetlands Bird Safari	50	None	41/100	41%	4/100	4%	Some	1/50	2%
		Partial	59/100	59%	15/100	15%	Most	4/50	8%
		More Complete	0/100	0%	81/100	81%	All	45/50	90%
Fun with Fishing	37	None	39/74	53%	3/74	4%	Some	0	0%
		Partial	32/74	43%	19/74	26%	Most	2/37	5%
		More Complete	3/74	4%	51/74	69%	All	35/37	95%
Canoeing	34	None	12/34	35%	1/34	3%	Some	0	0%
		Partial	21/34	62%	3/34	9%	Most	0	0%
		More Complete	1/34	3%	30/34	88%	All	34/34	100%
TOTAL	121	None Complete	92/208	44%	8/208	4%	Some	1/121	1%
		Partial Complete	112/208	54%	37/208	18%	Most	6/121	5%
		More Complete	4/208	2%	162/208	78%	All	114/121	94%

Table 4: Summary of RecMobile Attitudes

	Strongly Agree/Agree			Disagree/Strongly Disagree		
	Birding	Fishing	Canoeing	Birding	Fishing	Canoeing
Question 1 (I would tell my friends to do this program)	22	11	9	1	0	1
Question 2 (The activity was very interesting)	22	11	9	1	0	1
Question 3 (The activity was fun)	23	11	9	0	0	1
Question 4 (I would like to do another program of the same activity)	23	11	9	0	0	1
Question 5 (I would like to show my friends how to do the activity)	22	11	6	1	0	4
TOTAL	97%	100%	93%	2%	0%	18%

Table 5: Means and Standard Deviations for Specific Attitudes

Event	Mean		Standard Deviation	
	Pretest	Posttest	Pretest	Posttest
Wetlands Bird Safari	17.33	18.86	1.53	1.42
Fun with Fishing	18.77	19.33	1.26	1.02
Canoeing	19.11	19.61	1.64	.97

Table 6: Means and Standard Deviations for General Attitudes

Event	Mean		Standard Deviation	
	Pretest	Posttest	Pretest	Posttest
Wetlands Bird Safari	14.7	14.58	1.35	1.73
Fun with Fishing	14.82	15.58	1.7	1.0
Canoeing	14.82	15.58	2.03	1.06