

Summative Evaluation of
Dolphins

An IMAX[®] Dome Film and Associated Educational Resources

Report for

McGillivray Freeman Films

Laguna Beach, California

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Executive Summary

July 22, 2000

INTRODUCTION

The summative evaluation reported here focused on a large-format film, titled *Dolphins*, and associated educational resources for use in informal and formal settings. Each of these educational products was produced by MacGillivray Freeman Films in association with the National Wildlife Federation. Major funding for this project is provided the National Science Foundation and the Museum Film Network. Research methods gave consideration to the projected goals of this project, as specified in the body of the report.

EVALUATION GOALS & METHODS

Research activities for the summative evaluation of *Dolphins* were divided into the following two research components:

Adult Audience Study

A summative evaluation in Boston, Massachusetts at the Boston Museum of Science's Mugar OMNI Theater was carried out with adult (18+ years) viewers. The purposes for this evaluation component are to discern affective and cognitive effects for a volunteer audience with diverse demographics and a variety of reasons for attending the film.

A quasi-experimental separate-sample pretest/posttest design was used. Over a period of four weekdays and one weekend (May 10–16, 2000) during each showing of the film, researchers approached a randomly chosen sample of adults, stratified by gender. A random number of adults approached before viewing the film completed the previewing questionnaire that included questions on prior large-format film experience, viewing expectations, interest in learning about dolphins, estimation of current knowledge about dolphins, reading/performance of *Dolphins Family Fun Guide* activities, and demographics. Sixteen questions on film content were also asked to enable an analysis of learning outcomes. A random number of adults after the viewing responded to the same content questions contained in the previewing questionnaire as well as additional questions about the appeal and comprehensibility of the film and use of the *Dolphins Family Fun Guide*. The total number of usable questionnaires (N=417) included 205 pre-viewing questionnaires and 212 post-viewing questionnaires.

School Audience Study

A summative evaluation involving three middle schools (located in Clifton Park, New Jersey; Rochester, New York; and Hollywood, Florida) was carried out with a total of 132 seventh grade students. The purposes for this evaluation component are to discern for a school audience the affective and cognitive effects of the film alone and the film in conjunction with performing a minimum of three specified activities contained in the *Teacher's Guide* and reading the Introduction (pages 1–4). Toward this end, the school audience study focused on the following major outcomes:

- To what extent did *Dolphins* appeal to middle school viewers?

- To what extent did the film achieve its intended viewing goals? For example, did students acquire knowledge about science, especially with regards to dolphins?
- Did the implementation of school-based activities described in the *Dolphins Teacher's Guide* following film viewing affect learning outcomes?

A quasi-experimental pretest/posttest nonequivalent comparison group design was used with middle school students to evaluate the film and ancillary schoolroom activities. Intact school classes were assigned to one of two treatments: Viewing the film only (FILM) and doing related reading and activities after viewing the film (FILM + ACTIVITY). The two groups constituted naturally assembled collectives and were as similar as availability permitted, except for the diversity of geographical locations.

All students in the sample completed a pre-viewing questionnaire. Two weeks later, all students visited the Boston Museum of Science and viewed *Dolphins* in the Mugar OMNI Theater. The day after viewing the film, the teachers of three classes (one from each school) asked their students to read the Introduction and perform at least three activities contained in the *Dolphins Teacher's Guide* (i.e., Activity 4 [*What's the Chatter?*], Activity 7 [*Listen & Learn*], and Activity 9 [*Uncommon Sense!*]) to examine their impact on viewer learning outcomes. The following day, all students completed a posttest and opinion survey (In addition to content questions, the posttest included measures to compare with the previewing questionnaire results and open-ended questions which allowed for exploration of unintended effects.). In this way, a comparison was performed contrasting treatments of viewing the film alone and viewing the film prior to participation in pertinent project designed activities. Administration of the pretest and viewing of the film were separated in time by two weeks so that pre-testing effects would be minimal.

SUMMARY OF RESULTS

The following is a summary of findings obtained from both the adult and school audience studies:

Adult Audience Study

- *To what extent does Dolphins appeal to adult viewers?*

Approximately 79.2% of the adult sample rate *Dolphins* as “Very Interesting.” Another 14.6% rate the film as “Moderately Interesting.” Additionally, viewers were asked to rate how visually interesting or visually boring the film is, as well as the film’s level of entertainment. On a five-point Likert scale, the mean visual interest rating is 4.65, and the film’s level of entertainment obtained an average rating of 4.34. Viewers generally perceive the film’s pace to be suitable. Similarly, the post-viewing sample feels that the amount of facts presented in *Dolphins* is appropriate. Appeal ratings were found to be independent of gender, age group, education, and number of IMAX[®] films ever seen

- *Does the film meet viewer expectations?*

Prior to viewing *Dolphins*, the four categories of content that sample audience members most expect to be presented in the film are general information about dolphins, scenes and information about dolphin habitats, ocean/underwater scenery, dolphin social behavior. Subsequent to seeing the film, 97.0% of the post-viewing sample who reported having had expectations prior to seeing the film indicated that the film had either met or exceeded their expectations.

- *What do viewers like most about Dolphins?*

The four categories of content sample audience members reported liking most about *Dolphins* are the film's cinematography/photography, the film's positive educational value, the experiential qualities of the film, and the beauty of dolphins.

- *What do viewers like least about Dolphins?*

Of the viewers who responded to this inquiry, 39.8% commented that they like everything about the film. Responses indicating a disliked feature focused primarily on what is reported to be insufficient educational content, images that move too rapidly on the screen, discomfort with seeing dolphins injured or caught in a net, and too short a film.

- *What surprises viewers most about Dolphins?*

The four categories of film content that most surprises viewers are dolphin intelligence, dolphin gentleness, high quality cinematography, and dolphin vision.

- *What most disappoints viewers?*

The four categories of film content that most disappoints viewers focus primarily on what is reported to be discomfort seeing dolphins injured or caught in a net, insufficient educational content, too short a film, and too few types of dolphins are shown and discussed.

- *What most confuses viewers?*

Only six people in the 212 member post-viewing sample reported finding anything confusing about *Dolphins*. The following explanations about the confusing components are direct quotations from these members of the sample:

- "How long were the scientists able to stay underwater?"
- "How did the people breath under the water?"
- "When the female researcher comes up for air and shouts stats to the other girl."
- "Mentioned dolphins call each other by name, but then didn't explain."
- "The different types of dolphins and how do they differ, or do they?"
- "There is a part where a scientist in the Bahamas is diving. She tells other scientists in the boat something about the dolphin that I really couldn't get."

- *What are the learning outcomes associated with viewing Dolphins?*

Viewing the film significantly increased adult viewers' knowledge about topics associated with dolphins. The pre-viewing mean test score is 10.18 out of a possible 16 points compared with the significantly higher post-viewing mean score of 14.45. These scores do not show interactions with any of the demographic or background variables measured.

With regards to specific content areas in which knowledge increased, statistically significant improvement between the pre- and post-viewing respondents is evidenced for 14 of the 16 content questions. The two items for which this improvement is not demonstrated are: (1) "Dolphins usually live alone rather than in groups" and (2) "Dolphins may communicate more often when the water is clear." When interpreting these results, it is important to note that for the first of these items, the pretest score was so high, the probability that any post-test improvement would attain statistical significance is unlikely. The fact that dolphins usually live in social groups appears to be common knowledge.

In contrast, for the second item that did not garner demonstrable improvement, approximately half the members of the pre-viewing and post-viewing samples responded correctly, most likely reflecting guessing on this true-or-false item. Consequently, the scientist's observation that dolphins may communicate more often when the water is clear alluded the sample viewers.

- *What is the impact of the Dolphins Family Fun Guide?*

The *Dolphins Family Fun Guide* was distributed by ticket staff to individuals who purchased a pass to see *Dolphins*. A total of 39 pre-viewing respondents and 48 post-viewing respondents reported that they had read and/or performed activities contained in the *Guide* prior to viewing the film. While there is not a significant difference between the scores of Guide and non-Guide users, there is a consensus of opinion that it is both interesting and informative. Periodic examinations of trash receptacles throughout the theater and museum facilities revealed that only a very few of the approximately 500 Guides that were distributed over the course of this study had been thrown away. This finding suggests that film viewers attributed a positive value to the Guide and perhaps availed themselves of its use at a more convenient time. This conjecture is supported by reports from ticket sales staff that numerous requests for the Guide had been made by film viewers who had not received one, but had learned from other viewers that it had educational value and was available at the ticket counter.

School Audience Study

- *To what extent does Dolphins appeal to student viewers?*

Of the 132 student viewers participating in this study, 58.4% of the sample rated the film as either "Very Interesting" or "Moderately Interesting." On average, responses to *Dolphins* were positive, as indicated by students' rating of the film's appeal as 3.7 on a five-point Likert scale ranging from 1 (very boring) to 5 (very interesting). Appeal ratings were independent of treatment, gender, ethnicity, estimated prior knowledge about the film's topics, and prior interest in learning about dolphins.

- *What do students like most about Dolphins?*

The four categories of content the student sample reported liking most about *Dolphins* are the film's cinematography/photography, the experiential qualities of the film, the beauty of dolphins, and the IMAX experience. The fifth category of content most liked by students, and of special interest to this project, is scientific field research, as illuminated by the stories about scientists and their research.

- *What do students like least about Dolphins?*

Of the students who responded to this inquiry, 26.5% commented that they liked everything about the film. Responses indicating a disliked feature focused primarily on seeing dolphins injured or caught in a net, an experience of motion discomfort, excessive dialogue, and low interest value in some parts of the film (no descriptions offered).

- *What surprises students most about Dolphins?*

The four categories of film content that most surprised members of the student sample were the IMAX experience, the interaction between dolphins and humans, positive educational value of the film, and dolphin vision.

- *What most disappoints students?*

Of the students who responded to this inquiry, 27.3% commented that they liked everything about the film. Another 5.6% of the responses indicated that the only thing that was disappointing was when the film ended. Responses indicating disappointment focused primarily on the harm that's inflicted on dolphins by humans and sharks, low interest value in some parts of the film (no descriptions offered), the shortness of the film, and excessive dialogue.

- *What impact does the film have on students interest in learning more about dolphins?*

Measured on a five-point Likert scale ranging from 1 (not interested) to 5 (very interested), students' pre-viewing interest mean is 2.27 and the post-viewing interest mean is 2.86. An analysis of variance revealed that seeing the film and doing the classroom activities contained in the *Dolphins Teacher's Guide* had a significant positive impact on students' interest in learning more about dolphins.

- *Do students have any personal associations or connections with film content?*

After viewing the film, students were asked if the film reminded them of anything they previously knew or experienced. Seventeen respondents offered a variety of recollections.

- *What are the learning outcomes associated with students' viewing of Dolphins?*

Viewing the film significantly increased students' knowledge about topics associated with dolphins. The pre-viewing mean test score was 9.29, out of a possible 16 points, compared with a significantly higher post-viewing mean score of 12.98.

With regards to specific content areas in which knowledge increased, significant improvement between the pre- and post-viewing surveys is evidenced for 9 of the 16 content questions. The 7 items for which this improvement is not demonstrated are:

1. Dolphins are mammals.
2. Dolphins usually live in social groups
3. Dolphins may communicate more often when the water is clear.
4. Dolphins can look up with one eye and back with the other.
5. Dolphins do not breath through gills.
6. A dolphin's brain is larger than a dog's brain.
7. Dolphins can get caught I a fishing net.

When interpreting these results, it is important to note that for all of these items, except for the fourth (i.e., independent eye movement), the pretest score was very high. Hence, there was only marginal room for improvement, and the probability that any post-test improvement would attain statistical significance is unlikely. Students most likely learned this information from associated class assignments prior to their fieldtrip to view *Dolphins*.

Approximately half of the student sample responded correctly to the question about independent eye movement, most likely reflecting guessing on this true-or-false item. Consequently, this piece of information appears to have alluded these students.

When asked if they had learned anything about dolphins that they did not know before viewing the film, 88.6% of the students reported that they had. The six most frequently cited learning categories are information associated with

- Dolphin vision
- Dolphin communication
- Dolphin intelligence
- Echolocation
- Interaction with humans
- Scientific field research

• *Does performance of Teacher's Guide activities following film viewing affect outcomes?*

An analysis of variance revealed that, on average, there was a significant improvement in learning performance for students in both treatment groups (i.e., students who viewed the film and performed Teacher's Guide activities vs. students who only viewed the film). However, the increase in scores for the students who viewed the film and performed project activities (5.08 points) is generally double the increase in scores of the students who only viewed the film (2.45 points). Performing the activities contained in the *Dolphin's Teacher's Guide* does have a significantly positive impact on students' knowledge of film content.

Summative Evaluation of *Dolphins*

An IMAX[®] Dome Film and Associated Educational Resources

July 22, 2000

Introduction

Project Description

The summative evaluation reported here focused on the following three project components:

1. An IMAX[®] Dome film, titled *Dolphins*.
2. *Dolphins Family Fun Guide*, an educational accompaniment to the film distributed to viewers at the ticket counter prior to seeing the film.
3. An associated teacher's guide designed for widespread distribution.

Each of these educational products was produced by MacGillivray Freeman Films in association with the National Wildlife Federation. Major funding for this project is provided the National Science Foundation and the Museum Film Network. Research activities gave consideration to the goals of this project, which support national science learning goals by:

- stimulating the public's awareness of the scientific process and the benefits of scientific research;
- encouraging viewers to learn more about the film's topic via distribution of educational materials to theaters;
- assisting teachers with their use of the Activity Guide.

The 24-page *Dolphins Teacher's Guide* and *Dolphins Family Fun Guide* brochure contain information relating to science themes in the film and a variety of hands-on science activities, with an emphasis on multidisciplinary investigations, available as pre- and post-film resources, but not dependent on viewing the film. The guides were developed by the project for learners in both informal and formal settings..

Evaluation Goals

The general goals for this summative evaluation study are to assess the appeal of *Dolphins*, acquisition of scientific knowledge and understanding as related to the project's learning goals, understanding of the subject, and ability to apply relevant science concepts. Specific research issues and the methods of data gathering varied over the course of the project, but the general research issues to be addressed were the same for each component, as described below:

- To what extent does *Dolphins* appeal to adult and student viewers? Do viewers find the film to be visually interesting? What is its level of entertainment? Is the film's pace suitable? Is the amount of information contained in the film adequate? What do viewers expect to see in the film? How does *Dolphins* compare to these expectations? Is the appeal the same for students from different regions?
- Does the film meet viewer expectations?
- What do viewers like most about *Dolphins*?

- What do viewers like least about *Dolphins*?
- What surprises viewers most about *Dolphins*?
- What disappoints viewers most about *Dolphins*?
- What in the film most confuses viewers?
- What impact does the film have on viewer's interest in learning more about dolphins?
- Do students have any personal associations or connections with film content?
- What are the learning outcomes associated with viewing *Dolphins*? What ideas/facts do students report learning from the film? Do students perceive the film to be a useful resource for information about scientific field research?
- What is the impact of the *Dolphins Family Fun Guide* and *Dolphins Teacher's Guide*?

In accordance with the film's design for viewers of all ages from all walks of life, and the project's mission to introduce viewers to the importance of scientific field research through a film study that reveals the unique characteristics and diversity of dolphin physiology, behavior, society, and habitat, evaluation goals, sites, and target audiences were selected as specified in the following section of this report.

General Evaluation Design

Research activities for the summative evaluation of *Dolphins* were divided into the following two research components:

Adult Audience Study

A summative evaluation in Boston, Massachusetts at the Boston Museum of Science's Mugar OMNI Theater was carried out with adult (18+ years) viewers. The purposes for this evaluation component are to discern affective and cognitive effects for a volunteer audience with diverse demographics and a variety of reasons for attending the film.

A quasi-experimental separate-sample pretest/posttest design was used. Over a period of four weekdays and one weekend (May 10–16, 2000) during each showing of the film, researchers approached a randomly chosen sample of adults, stratified by gender. A random number of adults approached before viewing the film completed the previewing questionnaire that included questions on prior large-format film experience, viewing expectations, interest in learning about dolphins, estimation of current knowledge about dolphins, reading/performance of *Dolphins Family Fun Guide* activities, and demographics. Sixteen questions on film content were also asked to enable an analysis of learning outcomes. A random number of adults after the viewing responded to the same content questions contained in the previewing questionnaire as well as additional questions about the appeal and comprehensibility of the film and use of the *Dolphins Family Fun Guide*.

As described below, several characteristics of the population and treatment (i.e., the IMAX® film) led to the decision to use this design, which Campbell and Stanley (1963) refer to as Design 12.

- First, the population to which we wish to generalize are self-selected museum visitors whose intention is to view an IMAX® Dome film. Locating an equivalent control group who would not view the film was virtually impossible. There were no comparable museum visitors from whom the treatment (the film) could be withheld. The best control group was a sample of museum visitors who intended to view the film but had not yet done so.
- Secondly, we could not assume that the scientifically predisposed museum visitors would be unfamiliar with the film content, thus it was important to include a pretest that established what the audience knew prior to seeing the film. Pre-testing and post-testing the same sample, however, was not an acceptable procedure, because the pretest almost certainly would sensitize the audience to the content of the film and affect their posttest results. The separate-sample design controls for the main and interactive effects of testing. One group is tested prior to seeing the film and a randomized equivalent group tested after seeing the film.
- Third, random sampling was logistically simple in the theater environment where the audience lines up before show time. Randomization was used to eliminate systematic bias between the pre-viewing sample and the post-viewing sample. As argued by Campbell and Stanley (1963), “the most adequate all-purpose assurance of lack of initial biases between groups is randomization” (Page 25).
- Fourth, the drawbacks of this design, in general, are its failure to control for history, maturation, mortality and the interaction of these. However, in this specific case, where the film treatment is only 40 minutes long and the adult audience is virtually captive, there is little chance of changes in groups due to history, maturation, or mortality; thus, these are non-issues for this evaluation.

In conclusion, the separate-sample pretest-posttest design was considered the strongest approach for evaluating the IMAX® Dome film in the natural theater setting with a random sampling of the population of movie-goers. This research design was found effective in evaluating the IMAX® Dome films *Stormchasers* (Flagg & Johnson, 1996), *Special Effects* (Flagg & Johnson, 1997), and *Everest* (Johnson, 1998) and was applied to *Dolphins* to add to our baseline knowledge about effects of large-format films. As described below, the school audience study uses conventional treatment/control group methodology.

School Audience Study

A summative evaluation involving three middle schools (located in Clifton Park, New Jersey; Rochester, New York; and Hollywood, Florida) was carried out with a total of 132 seventh grade students. The purposes for this evaluation component are to discern for a school audience the affective and cognitive effects of the film alone and the film in conjunction with performing a minimum of three specified activities contained in the *Teacher's Guide* and reading the Introduction (pages 1–4). Toward this end, the school audience study focused on the following major outcomes:

- To what extent did *Dolphins* appeal to middle school viewers?
- To what extent did the film achieve its intended viewing goals? For example, did students acquire knowledge about science, especially with regards to dolphins?
- Did the implementation of school-based activities described in the *Dolphins Teacher's Guide* following film viewing affect learning outcomes?

A quasi-experimental pretest/posttest nonequivalent comparison group design was used with middle school students to evaluate the film and ancillary schoolroom activities. Intact school classes were assigned to one of two treatments: Viewing the film only (FILM) and doing related reading and activities after viewing the film (FILM + ACTIVITY). The two groups constituted naturally assembled collectives and were as similar as availability permitted, except for the diversity of geographical locations.

All students in the sample completed a pre-viewing questionnaire. Two weeks later, all students visited the Boston Museum of Science and viewed *Dolphins* in the Mugar OMNI Theater. The day after viewing the film, the teachers of three classes (one from each school) asked their students to read the Introduction and perform at least three activities contained in the *Dolphins Teacher's Guide* (i.e., Activity 4 [*What's the Chatter?*], Activity 7 [*Listen & Learn*], and Activity 9 [*Uncommon Sense!*]) to examine their impact on viewer learning outcomes. The following day, all students completed a posttest and opinion survey (In addition to content questions, the posttest included measures to compare with the pre-viewing questionnaire results and open-ended questions which allowed for exploration of unintended effects.). In this way, a comparison was performed contrasting treatments of viewing the film alone and viewing the film prior to participation in pertinent project designed activities. Administration of the pretest and viewing of the film were separated in time by two weeks so that pre-testing effects would be minimal.

Methods & Demographics

Adult Audience Study

The population from which the sample was randomly chosen was comprised of audience members who stood in the waiting line to view *Dolphins* during a period of six days in May, 2000. All of the questionnaire respondents were 18 years or older. Single adults accompanied by children below the age of five and adults who were part of a group of five or more were excluded.

Of the 426 adults who were randomly selected to participate in the evaluation, 9 people declined responding to the post-viewing questionnaire because of prior appointments, ongoing conversations, etc. Thus, the total number of usable questionnaires (N=417) included 205 pre-viewing questionnaires and 212 post-viewing questionnaires.

Researchers recruited over a period of four non-holiday weekdays and one weekend, eliciting responses to questionnaires during 26 shows. Information from demographic and background questions was used to determine whether the randomization worked well in equalizing the pre and post-viewing groups and whether the two independent samples should be looked at as having come from the

same population. Chi-square analyses revealed that the Viewing Groups (Pre and Post) did not differ significantly with respect to the classifications of gender, age group, education, and the number of IMAX® films seen prior to viewing *Dolphins*.

For the sample as a whole, the classification variables of gender (49.0% female, 51.0% male), age group, education, occupation, and number of IMAX® films seen were fairly equally distributed across the categories. The distribution of the sample on these classification variables is presented in Table 1, on the following page.

Table 1. Demographic and Background Variables*

Variable	N	Categories	Percent
Gender	417	Female	48.9%
		Male	51.1%
Age Group	417	18-27	19.7%
		28-37	25.9%
		38-47	32.6%
		48+	21.8%
Education	417	Some high school	5.8%
		High school	23.5%
		College graduate	43.4%
		Graduate or professional degree	21.1%
		Other	5.8%
		No Response	0.5%
Occupation	417	Related to science	46.0%
		Not related to science	53.5%
		No Response	0.5%
Number of IMAX® films ever seen	417	This is my first film	21.3%
		One other film	13.4%
		2 other films	16.1%
		3 other films	23.7%
		Four or more films	25.4%

*Totals may not equal exactly 100.0% due to rounding.

Prior to viewing *Dolphins*, respondents were asked to rate their interest level in learning about dolphins. Of the 205 responses received, 84.4% were either “very interested” or “moderately interested.” About 15.6% of responding viewers reported being “a little interested,” and none of the respondents to this inquiry reported “not interested at all.” See Table 2.

Table 2. Interest in Learning about Dolphins by Pre-Viewing Sample

Variable	N	Categories	Percent
Interest	205	Very Interested	34.2%
		Moderately Interested	50.2%
		A little interested	15.6%
		Not interested at all	0.0%

Participants in the pre-viewing sample did not report high levels of knowledge about dolphins, prior to viewing the film. Of the 205 members of the pre-viewing sample, 4.4% felt they knew “a lot,” and about one-third of these viewers (32.7%) reported knowing “a moderate amount.” Over half of the pre-viewing sample (58.5%) endorsed knowing “a little” on the questionnaire, and about 4.4% reported having no knowledge in this area. Note that the percentages of viewers who reported knowing “a lot” and “nothing” (the two most extreme responses) were identical, and represented only 8.8% of the total pre-viewing sample (See Table 3).

Table 3. Self-Report of Knowledge About Dolphins by Pre-Viewing Sample

Variable	N	Categories	Percent
Knowledge	205	I know a lot.	4.4%
		I know a moderate amount.	32.7%
		I know a little.	58.5%
		I know nothing.	4.4%

School Audience Study

Three middle schools who were registered to view *Dolphins* in April, 2000 were contacted about participating in the study. As indicated in Table 4, the first middle school provided 51 seventh-grade students, the second middle school provided 43 seventh-grade students, and the third middle school provided 38 seventh-grade students. An approximately equal percentage of females (53.0%) and males (47.0%) participated in the school audience study.

Table 4. Demographics of Participating Schools

City	State	Grade	N	Males	Females	Date Viewed
Rochester	New Hampshire	7	51	25	26	April 19, 2000
Clifton Park	New York	7	43	20	23	April 13, 2000
Hollywood	Florida	7	38	17	21	April 13, 2000

Paired pre- and post-viewing questionnaires were obtained from a total of 132 middle school students. There were 79 students in the FILM treatment (i.e., viewed the film only) and 53 students in the FILM + ACTIVITY treatment (i.e., performed activities contained in the *Dolphins Teacher's Guide* in school one day after viewing the film).

Information from demographic and background questions was used to determine whether the two treatment groups were equivalent samples. Chi-square analyses revealed that the treatment groups (i.e., FILM, FILM + ACTIVITY) did not differ significantly with respect to the classifications of gender, ethnicity, reported interest in learning about dolphins, and reported knowledge about dolphins prior to viewing the film. The distribution of the sample on these classification variables is presented in Table 5. Comparison between pre- and post-viewing interests in learning about dolphins is discussed later in this report.

Table 5. Demographic & Background Variables of Student Sample*

Variable	N	Categories	Percent
Gender	132	Female	47.0%
		Male	53.0%
Ethnicity	132	White	60.0%
		Asian American	8.3%
		Black / African American	17.4%
		Latino / Hispanic	12.1%
		American Indian / Alaskan Native	2.3%
Initial interest in learning about dolphins	132	Very interested	15.2%
		Moderately interested	25.0%
		A little interested	32.6%
		Not at all interested	27.3%
Self-reported knowledge about dolphins prior to viewing the film.	132	I know a lot.	9.9%
		I know a moderate amount.	34.9%
		I know a little.	49.2%
		I know nothing.	6.1%

*Totals may not equal exactly 100.0% due to rounding.

Students were asked to indicate their parent's/guardian's occupation. The distribution of this variable is presented in Table 6.

Table 6. Employment of Parents/Guardians

Occupation	Rochester, NH		Clifton Park, NY		Hollywood, FL		Total
	Father	Mother	Father	Mother	Father	Mother	
Professional (business)	5	4	3	2	3	0	17
Professional (science)	2	2	1	1	0	1	7
Educator	1	3	0	1	0	2	7
Administrator	4	2	3	2	2	1	14
Manager	5	4	2	3	2	3	19
Technician	7	1	6	2	5	1	22
Clerical	0	8	4	4	4	5	25
Homemaker	0	7	0	5	0	4	16
Worker (skilled)	10	3	9	4	8	7	41
Worker (semiskilled)	8	7	8	7	7	5	42
Worker (unskilled)	5	4	6	5	6	4	30
No response	4	6	1	7	1	5	24

Procedure

Three teachers (one from each of the participating schools) were provided with a set of written instructions for administering questionnaires. These teachers also assumed responsibility for distributing *Dolphins Teachers Guides* to other teachers whose classes viewed the film. They also divided classes into treatment groups.

Two weeks prior to viewing *Dolphins*, each of the teachers administered the pre-viewing questionnaire. All 132 students in the sample completed the questionnaire as part of their regular classroom activity. Teachers did not mention that the questionnaire was associated with *Dolphins* or the planned fieldtrip to the Boston Museum of Science's Mugar OMNI Theater. Questions on the pre-viewing questionnaire focused on demographic and background classification variables as well as pre-viewing knowledge about and interest in the film's topics.

Two weeks after responding to the pre-viewing questionnaire, all students visited the Boston Museum of Science and viewed *Dolphins*. The day after viewing the film, two teachers (one from each school) who had each been provided with 25 copies of the *Dolphins Teacher's Guide*, asked their seventh-grade students to perform at least three activities (i.e., Activity 4 [*What's the Chatter?*], Activity 7 [*Listen & Learn*], and Activity 9 [*Uncommon Sense!*]). Criterion for activity selection was based upon a correspondence with film content.

In compliance with instructions provided to the teachers, 53 students (i.e., members of the FILM + ACTIVITY treatment group) performed the activities listed in Table 7 to discern whether or not implementation of school-based activities contained in the *Dolphins Teacher's Guide* following viewing of the film affects viewer learning outcomes. The day following performance of the activities, all 132 of the sample students (i.e., members of both treatment groups) completed a posttest and opinion survey.

Table 7. Activities Performed by Treatment Group

Page	Topic/Title
1-4	Introduction (reading assignment)
10, 11	What's the Chatter?
16, 17	Listen & Learn
20, 21	Uncommon Sense!

Questions on the post-viewing survey included the pre-viewing film content questions and additional questions to assess viewers' reactions to the film, as described below.

Questionnaires

Demographic and Background Variables. The pre-viewing questionnaire established respondents' status with respect to demographic classification variables (gender, ethnicity, and parent's/guardian's occupation), background classification variables (pre-viewing interest in and pre-viewing knowledge of the film's topics).

Film Appeal. Post-viewing respondents chose one of five scaled statements to indicate how interesting or boring they found *Dolphins*. Viewers also explained what they liked and did not like about the film and why. Finally, an attempt was made to capture unintended effects by utilizing the completion items: "I was surprised . . ." and "I was disappointed . . .".

Science Interests. Students rated their level of interest in learning about dolphins both prior to and after viewing *Dolphins*.

Science Knowledge. Both the pre-viewing and post-viewing questionnaires included a knowledge test to assess understanding of science content associated with the film's viewing goals. Sixteen true-or-false questions, also used for formative evaluation, comprised a 16-point test about the following topics covered in the 40-minute film. The questions and answers drawn from the film's content appear below.

- | | |
|---|-------|
| 1. Dolphins are mammals. | True |
| 2. Dolphins live in every sea on Earth. | True |
| 3. Dolphins usually live alone rather than in social groups. | False |
| 4. Echolocation permits dolphins to find food in the sand. | True |
| 5. Jumping into the air allows dolphins to see birds five miles away. | True |
| 6. Dolphins can read sign language better than chimpanzees can. | True |
| 7. Dolphins are always friendly to humans. | False |
| 8. Some sharks attack and eat dolphins. | True |
| 9. Dolphins may communicate more often when the water is cloudy. | False |
| 10. Dolphins can look up with one eye and back with the other. | True |
| 11. Dolphins compete for food without any organized teamwork. | False |
| 12. Dolphins are able to sleep with one eye open. | True |
| 13. Some dolphins live in fresh water rivers. | True |
| 14. Dolphins breath through gills. | False |
| 15. A dolphin's brain is larger than a dog's brain. | True |
| 16. Dolphins are too large and strong to get caught in a fishing net. | False |

To gain insight into additional knowledge gained, post-viewing students were also asked if they learned anything about dolphins that they did not know before viewing the film. If so, they were asked to specify what they had learned.

RESULTS – Adult Audience Study

Appeal of *Dolphins*

After seeing the film, respondents were asked to rate how interesting or boring *Dolphins* is (See Table 8). On average, respondents gave the film a 4.71 rating on a five-point Likert scale ranging from 1 (Very Boring) to 5 (Very Interesting). Approximately 79.2% of the sample rated the film as “Very Interesting.” Another 14.6% of the sample rated the film as “Moderately Interesting” and 4.7% rated it as “Okay.” About 0.5% rated *Dolphins* as “Moderately Boring” and 1.0% of the respondents thought the film was “Very Boring.”

Table 8. Rating of Overall Appeal of *Dolphins* by Post-Viewing Sample

<i>Variable</i>	<i>N</i>	<i>Categories</i>	<i>Percent</i>
Appeal	212	Very Interesting	79.2%
		Moderately Interesting	14.6%
		Okay	4.7%
		Moderately Boring	0.5%
		Very Boring	1.0%

Appeal ratings were found to be independent of gender, age group, education, and number of IMAX® films ever seen.

Additionally, viewers were asked to rate how visually interesting or visually boring the film is, as well as the film’s level of entertainment. A rating scale ranging from 1 to 5 was used, with 1 representing the most negative response (i.e., visually boring, not entertaining) and 5 representing the most positive response (i.e., visually interesting, very entertaining). Using this scale, respondents rated the film well above average on these two features. The mean visual interest rating was 4.65, and the film’s level of entertainment averaged a rating of 4.34 (See Table 9).

Viewers responded positively, when asked to rate the pace of the film. Ratings averaged 3.19 on a scale ranging from 1 (too slow) to 5 (too fast). Therefore, with the average of the ratings falling between the two extremes, respondents generally perceived the film’s pace to be suitable. Similarly, the post-viewing sample felt that the amount of facts presented in *Dolphins* was appropriate. On a scale ranging from 1 (too little information) to 5 (too much information), the mean response for the item, “Please rate the amount of information contained in the film” was 3.21 (See Table 9).

Table 9. Rating of Specific Appeal Factors of Film by Post-Viewing Sample

<i>Variable</i>	<i>n</i>	<i>Mean (sd)</i>
Visual Interest	212	4.65 (.61)
Level of Entertainment	212	4.34 (.79)
Pace	212	3.19 (.61)
Amount of information	212	3.21 (.68)

How the Film Does or Does Not Meet Expectations

Prior to viewing *Dolphins*, members of the pre-viewing sample were asked to describe what they expected to see in the film. Responses to this inquiry were received from 128 (62.4%) individuals. Eleven respondents merely wrote the word “dolphins.” The following two comments best exemplify the tone of written responses and verbal feedback offered by viewers prior to seeing the film:

- *“I expect to be both entertained and informed about dolphins and their actions in their natural habitats.”*
- *“Visually excellent quality of film that educates and entertains.”*

As illustrated in Table 10, expecting to learn general information about dolphins was reported by 27 (13.2%) of the respondents to this inquiry. Other respondents expected to see and learn about dolphin habitats (11.7%), general ocean and underwater scenery (9.3%), dolphin social behavior (5.8%), dolphin communication (5.4%), and dolphin intelligence (2.0%). The film’s experiential qualities were most anticipated by 1.5% of the sample. One respondent hoped to see “More action, less study.” Six respondents reported having no expectations of what they would see in *Dolphins*.

Table 10. Expectations of *Dolphins* by Pre-Viewing Sample

Categories	N	Examples of Responses
Learn general information about dolphins	27	<i>“I expect to be informed about dolphins.”</i> <i>“Visual and auditory explanations of dolphin behavior.”</i> <i>“Information about dolphin behavior and physiology.”</i>
See and learn about dolphin habitats	24	<i>“I expect to see different types of dolphins and the different habitats that they live in.”</i> <i>“I expect to learn about dolphin habitats.”</i> <i>“I expect to see dolphins in their natural habitat displaying their means of survival.”</i>
See general ocean and underwater scenery	19	<i>“Gorgeous underwater scenes.”</i> <i>“Wonderful underwater photography.”</i> <i>“Underwater flora and fauna, hopefully with some funny-looking scenes!”</i>
See and learn about dolphin social behavior	12	<i>“I expect to learn about the socialization of dolphins, how they relate to each other and other species.”</i> <i>“To learn about dolphin social structure.”</i> <i>“Relationships among dolphins and family interactions.”</i>
See and learn about dolphin communication	11	<i>“To learn about how dolphins communicate with each other and with humans.”</i> <i>“To learn about dolphin communication.”</i> <i>“I expect to see dolphins communicating in some way.”</i>
See and learn about dolphin intelligence	4	<i>“I expect to learn about dolphin intelligence.”</i> <i>“I expect to see examples of dolphin intelligence.”</i> <i>“To learn more about this super intelligent mammal with exquisitely sensitive sonar. Their brain has more convolutions and gray matter than ours.”</i>
Experiential qualities of the film	3	<i>“To feel as though I’m swimming with the dolphins and see them close-up.”</i> <i>“I expect to feel part of the picture. I hoping for some sensations of things coming out of the screen because of the screen size.”</i> <i>“The feeling of being with the dolphins in their own environment.”</i>
Miscellaneous comments	1	<i>“More action, less ‘study’.”</i>

Subsequent to seeing the film, members of the post-viewing sample were asked to choose from a selection of four statements the one that best describes how *Dolphins* compared to their expectations. Responses were received from 212 (100.0%) of these viewers. As illustrated in Table 11, 62 (29.2%) members of the sample reported the film exceeded my expectations. Similarly, 68 (32.1%) respondents indicated that the film met my expectations. In contrast, 4 (1.9%) members of the post-viewing sample felt that *Dolphins* did not meet their expectations. A total of 78 (36.8%) members of the sample reported having no preconceived expectations.

Table 11. How *Dolphins* Compared to Viewer Expectations

<i>N</i>	<i>Categories</i>	<i>Number</i>	<i>Percent</i>
212	The film exceeded my expectations.	62	29.2%
	The film met my expectations.	68	32.1%
	The film did not meet my expectations.	4	1.9%
	I had no expectations before seeing the film.	78	36.8%

*Percentages sum to 100.1 %, as a result of rounding.

The following two comments were offered as explanations for why the film had not met their expectations:

- “It lacked information.”
- “I had not expected to see the killing [of dolphins].”

One other respondent offered the following response in regards to the meeting of expectations:

- “I hoped it would be entertaining for the kids as well, and it was.”

Another respondent offered the following observation:

- “The film met all of my expectations.”

What Viewers Like Most About *Dolphins*

After viewing the film, the post-viewing respondents were asked what they liked about *Dolphins*, and why. Of the 212 viewers who were asked this question 189 (89.2%) provided an answer. Responses were sorted into the categories presented in Table 12, on the following page. From this sample, 11 respondents reported that they liked everything about the film. The following five comments best exemplify the tone of written and verbal feedback offered by viewers after seeing the film:

- “Wonderful combination of real and virtual images. Good script with informative scenes and explanations and elements of poetry and humor.”
- “Great mix of visual entertainment and education.”
- “Right amount of information, beauty, lively music & IMAX motion.”
- “It taught me to respect dolphins and protect them.”
- “I liked everything. Very interesting. Made me cry! Great music too.”

In addition to the comments above, as illustrated in Table 12, about 24.9% of the respondents reported liking the film’s cinematography most. Besides the general appeal of the cinematography / photography, the most frequent response in this category related to the film’s positive educational value (20.6%), experiential qualities of the film (8.5%), the beauty of dolphins (7.4%), and learning about dolphin social behavior (5.8%). Approximately 4.8% liked the film’s sound track and music. In addition to other liked features listed below, 5 viewers offered miscellaneous feedback.

Table 12. What Viewers Liked Most About Dolphins

Categories	N	Examples of Responses
Cinematography	47	<p>"The cinematography was excellent!"</p> <p>"Beautiful cinematography held my interest."</p> <p>"I liked how it showed the ocean on a map and pulled the map away to show the actual land and water. Great cinematography."</p>
Positive Educational value	39	<p>"I loved it. It was educational, but not overwhelmingly so. It showed, albeit briefly, all different aspects of a dolphin's survival and I felt it covered all the bases."</p> <p>"Very informative with great learning experiences, especially for school age viewers."</p> <p>"The movie presented a lot of information in a dynamic way. It kept me awake."</p>
Experiential qualities of the film	16	<p>"I liked going in the water because I thought I was one of them."</p> <p>"Because I felt like I was really swimming with them."</p> <p>"I liked the feeling of swimming with them. It felt good."</p>
The beauty of dolphins	14	<p>"They are my favorite mammals. It's good to finally view a movie about them. They are so majestic."</p> <p>"Dolphins are great sleek mammals."</p> <p>"Dolphins are mysterious and majestic."</p>
See and learn about dolphin social behavior	11	<p>"Dolphins and their interaction with each other and man."</p> <p>"Dolphins socializing with other dolphins and humans."</p> <p>"Their social skills."</p>
The film's sound track and music	9	<p>"Beautiful, great sound track."</p> <p>"The sound was an excellent compliment to the movie."</p> <p>"Great music, especially the string music."</p>
Demonstrations of dolphin intelligence	8	<p>"Demonstrations of their intelligence."</p> <p>"The dolphins doing aerial gymnastics. Very intelligent."</p> <p>"I like the intelligent tricks the dolphins performed."</p>
See and learn about dolphin intelligence	7	<p>"We liked how the film explained how intellectual the dolphins really are."</p> <p>"Learning how dolphins are intelligent and naturally gifted."</p> <p>"Learning things about dolphin intelligence."</p>
See and learn about dolphin communication	7	<p>"I liked the parts about dolphin communication. Never heard it before."</p> <p>"Learning about dolphin communication skills."</p> <p>"Learning about how they communicate with each other when they perform tricks."</p>
The narration	6	<p>"The language the even a 4-year-old could understand."</p> <p>"I liked the narration."</p> <p>"Narration."</p>
The stories about scientists and their research	5	<p>"I liked the different stories about scientists and how they communicate with dolphins."</p> <p>"The story about the personal connection of the two people who worked with dolphins."</p> <p>"The story of Jojo."</p>
The action/pace of the film	4	<p>"I liked Dolphins because it had lots of action."</p> <p>"It was quick paced."</p> <p>"The film was fast paced."</p>
Entertainment value	2	<p>"The film was fun, entertaining."</p> <p>"Dolphins was especially entertaining."</p>
Miscellaneous comments	5	<p>"The film made it real how important it is for people to be aware of respecting the oceans and creatures within it."</p> <p>"The clarity and care."</p> <p>"The tone of the film."</p> <p>"Visiting different locations."</p> <p>"The volume was too loud."</p>

What Viewers Do Not Like About *Dolphins*

After the film, visitors were asked also what they liked least about *Dolphins* and why. Of the 212 viewers who were asked to respond to this question, 93 (43.9%) provided an answer. A total of 37 (40%) of these responses indicated that there was nothing about the film that the respondent did not like. For example, one respondent wrote, "I liked everything!" Another respondent commented, "There wasn't anything I didn't like." The only thing that one respondent did not like about the film was that "It had to end."

Responses indicating a disliked feature were sorted into categories presented in Table 13. As mentioned above, about 40% of the respondents liked everything about *Dolphins*. In contrast, about 17.2% felt that the film should contain more information. About 7.5% of the responses expressed the feeling that some of the images moved to fast. Another 6.5% thought that the film was too short. Approximately 3.2% of respondents felt that the film's pace is too slow. A similar number of respondents (2) reported that there was not enough information about the researchers, the film didn't full utilize IMAX capabilities, and the volume level was too loud.

Table 13. What Viewers Liked Least About *Dolphins*

<i>Categories</i>	<i>N</i>	<i>Examples of Responses</i>
Not enough educational content	16	"My frustration was not to be able to know more." "Not enough information of scientific or environmental nature." "Could have been more informative."
Images moved too fast	9	"The images moved a little too fast." "Footage was, at times, too fast. 3-D was hard to view." "Some images blurred."
Seeing dolphins caught in a net	7	"The tuna net made me very sad." "The dolphins trapped I the tuna net, it was upsetting." "Killing I fish nets was disturbing."
The film is too short	6	"Not long enough. I could sit through this all night." "I would have liked it to go longer, it was great!" "Wish it could have lasted longer and learned even more."
Not enough information about dolphin communication	4	"Not enough information on language study." "Could have touched more on their abilities to communicate." "Needed more about communication."
The film's pace is too slow	3	"A little slow." "Slightly slow at times." "A bit slow in parts."
Not enough information about researchers	2	"I wondered what organization Katherine was connected to for larger research and what other research is in progress like language, therapy, etc.." "Who were these people. Need more information."
Didn't fully utilize IMAX capabilities	2	"Misuse of IMAX capabilities, could have been regular film." "The lack of Omni experience."
The volume level was to loud	2	"Music too loud – sometimes it interfered with listening to the dolphins." "Volume too loud."
Miscellaneous comments	5	"The script/dialog were very "amateurish." Sometimes the sudden cuts from one scene to another were disconcerting." "Not enough action." "Some of the images screened high on the ceiling were hard to see." "Centers too much on feeding habits." "Too much talking toward the end of the film."

What Surprises Viewers

In order to capture unplanned appeal effects, the post-viewing sample was asked to complete the sentence, "I was surprised . . ." Nearly half (47.2%) of the sample wrote no answer to the question. Responses were sorted with keywords and the number of responses in each mutually exclusive category are presented in Table 14. About 17.0% of the respondents to this inquiry were surprised by dolphin intelligence. Another 14.3% were surprised by dolphin gentleness. About 12.5% were surprised by the quality of the cinematography. Slightly more than 11.6% reported being surprised by dolphin vision and 9.8% were surprised by dolphin communication.

Table 14. Respondents' Completion of "I was surprised . . ."

Categories	N	Examples of Responses
Dolphin intelligence	19	"how intelligent dolphins are." "by the intelligence of dolphins." "about how intelligent dolphins are."
Dolphin gentleness	16	"how gentle they are." "at how gentle they can be." "by the tenderness of the dolphins."
Quality of Cinematography	14	"the photography was amazing." "by the great shots and filming of the dolphins." "that the photography was so good."
Dolphin vision	13	"that dolphins sleep with one eye open." "that dolphins can see in front of them and behind them." "that dolphins can see in the air as well as in the water."
Dolphin communication	11	"to hear that dolphins communicate with each other." "by what is known about dolphin communication." "how well dolphins communicate with each other."
IMAX experience	8	"that I actually felt a part of the excursion." "at the realism of the film." "at how real everything seemed."
Diversity of dolphins	6	"at the diverse number of dolphin species." "by the variety of dolphins." "by all the kinds of dolphins there are."
That dolphins are endangered	5	"dolphins are in so much danger." "how endangered dolphins are." "that so many dolphins have been killed in tuna nets."
Quality of soundtrack	4	"with the quality of the soundtrack." "by the soundtrack." "quality of sound in the film."
Dedication of researchers	2	"at the people who have dedicated their lives to the study of dolphins." "there are scientists who can spend their lives studying."
Orcas are dolphins	2	"that Orcas are dolphins." "that the Killer Whale was a dolphin."
Diver ability to stay underwater	2	"at how long the people could stay underwater without oxygen tanks." "at how long the girl in the red suit could hold her breath."
Size of dolphins	2	"how large dolphins are." "to see how big dolphins are."
Echolocation	2	"that they use sound to find food in the sand." "they dig food out the sand using echolocation."
Miscellaneous comments	6	"that I didn't know as much as I thought I did." "by some of the facts I learned about dolphins." "that dolphins are so complicated."

What Most Disappoints Viewers

Post-viewing survey respondents also completed the sentence stem: "I was most disappointed . . ." Approximately 73.6% of the sample wrote no answer to the question. Responses were sorted with keywords and percentages of each mutually exclusive category are shown in Table 15. Of the 56 viewers who responded to this inquiry, 17 (30.4%) indicated that nothing about the film was disappointing. About 28.6% of the respondents to this inquiry reported that they were disappointed by the killing of dolphins. Other members of the sample (17.9%) felt that the film did not contain enough educational content. About 10.7% perceived that the film was too short. Two respondents felt there were too few types of dolphins shown and discussed. Another two other members of this sample reported that they were disappointed that the film ended.

Table 15. Respondents' Completion of "I was most disappointed. . ."

<i>Categories</i>	<i>N</i>	<i>Examples of Responses</i>
Killing of dolphins	16	<i>"about how many dolphins are killed in nets." "to learn of ongoing killing of dolphins by fisherman." "to see that the fishing nets are still a problem."</i>
Not enough educational content	10	<i>"not to see more of an informational description of various dolphins." "not to learn more about dolphin communication." "more environmental information wasn't provided."</i>
The film is too short	6	<i>"that the film was not longer." "that is was so short." "it wasn't longer."</i>
Too few types of dolphins shown and discussed	3	<i>"that more types of dolphins were not featured." "not seeing more types of dolphins." "to see only 4 or 5 species. I would have liked to see more and compare more."</i>
That the film ended	2	<i>"when the film was over." "when it ended."</i>
Miscellaneous comments	2	<i>"at the blurring and jerking in parts." "they have not figured out the language of the dolphins."</i>

What Confuses Viewers

Of the 212 members of the post-viewing sample, only 6 (2.8%) reported finding anything confusing about *Dolphins*, when queried. The following explanations about the confusing components are direct quotations from these members of the sample:

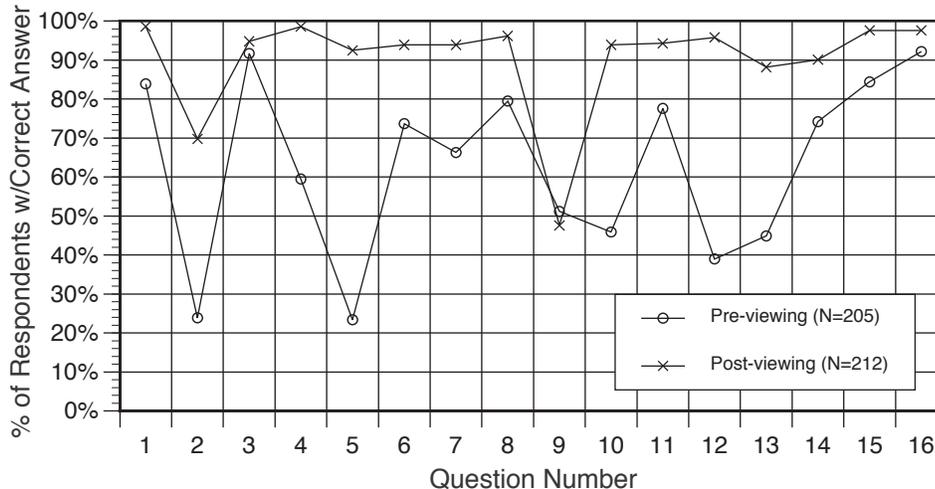
Q: Was there anything about the film that you found confusing? If so, what?

- *"How long were the scientists able to stay underwater?"*
- *"How did the people breath under the water?"*
- *"When the female researcher comes up for air and shouts stats to the other girl."*
- *"Mentioned dolphins call each other by name, but then didn't explain."*
- *"The different types of dolphins and how do they differ, or do they?"*
- *"There is a part where a scientist in the Bahamas is diving. She tells other scientists in the boat something about the dolphin that I really couldn't get."*

Learning Outcomes

Learning outcomes were assessed via a test with 16 true-false items. Figure 1 shows the distribution of the test scores for both the pre-viewing and post-viewing samples.

Figure 1. Distribution of Test Scores for Pre- and Post-Viewing Samples



The mean achievement score for the pre-viewing group is 10.18 and for the post-viewing group, 14.45. An analysis of variance indicated that the means are significantly different, $F(1, 415) = 644.22, p \leq 0.0001$. Thus, the learning outcomes resulting from viewing *Dolphins* are statistically significant.

With an interest in interaction effects, ANOVAs with interactions and nested factors were calculated for Survey (i.e., Pre, Post) and individual demographic/background variables of Gender, Age Group, Education, and Occupation. None of the interactions are statistically significant.

With regards to specific content areas in which knowledge increased, statistically significant improvement between the pre- and post-viewing surveys is evidenced for 13 of the 16 content questions. The three items for which this improvement is not demonstrated are: (1) "Dolphins usually live alone rather than in groups" and (2) "Dolphins may communicate more often when the water is clear." When interpreting these results, it is important to note that for the first of these items, the pretest score was so high, the probability that any post-test improvement would attain statistical significance is unlikely. The fact that dolphins usually live in social groups appears to be common knowledge.

In contrast, for the second item that did not garner demonstrable improvement, approximately half the members of the pre-viewing and post-viewing sample groups responded correctly, most likely reflecting guessing on this true-or-false item. Consequently, the scientist's observation that dolphins may communicate more often when in the water is clear, alluded the sample viewers.

Table 16. Percentage of Correct Responses by Pre- and Post-Viewing Samples

<i>Content Item</i>	<i>Pre-Viewing (% of Respondents)</i>	<i>Post-Viewing (% of Respondents)</i>	<i>Fisher's Exact Test</i>
Dolphins are mammals.	172 (83.9%)	209 (98.6%)	≤ .0001
Dolphins live in every sea on Earth.	49 (23.9%)	148 (69.8%)	≤ .0001
Dolphins usually live in social groups.	188 (91.7%)	201 (94.8%)	ns
Echolocation permits dolphins to find food in the sand.	122 (59.5%)	209 (98.6%)	≤ .0001
Jumping allows dolphins to see birds five miles away.	48 (23.4%)	196 (92.5%)	≤ .0001
Dolphins can read sign language better than chimpanzees can.	151 (73.7%)	199 (93.9%)	≤ .0001
Dolphins are not always friendly to humans.	136 (66.3%)	199 (93.9%)	≤ .0001
Some sharks attack and eat dolphins.	163 (79.5%)	204 (96.2%)	≤ .0001
Dolphins may communicate more often when the water is clear.	105 (51.2%)	101 (47.6%)	ns
Dolphins can look up with one eye and back with the other.	94 (45.9%)	199 (93.9%)	≤ .0001
Dolphins obtain food using organized teamwork.	159 (77.6%)	200 (94.3%)	≤ .0001
Dolphins are able to sleep with one eye open.	80 (39.0%)	203 (95.8%)	≤ .0001
Some dolphins live in fresh water rivers.	92 (44.9%)	187 (88.2%)	≤ .0001
Dolphins do not breath through gills.	152 (74.2%)	191 (90.1%)	≤ .0001
A dolphin's brain is larger than a dog's brain.	173 (84.4%)	207 (97.6%)	≤ .0001
Dolphins can get caught in a fishing net.	189 (92.2%)	207 (97.6%)	= .0130

* Not statistically significant

The *Dolphins Family Fun Guide* was distributed by ticket staff to individuals who purchased a pass to see *Dolphins*. A total of 39 pre-viewing respondents and 48 post-viewing respondents reported that they had read and/or performed activities contained in the *Dolphin's Family Fun Guide* prior to viewing the film. While there is not a significant difference between the scores of Guide and non-Guide users, there is a consensus of opinion that it is both interesting and informative. Periodic examinations of trash receptacles throughout the theater and museum facilities revealed that only a very few of the approximately 500 Guides that were distributed over the course of this study had been thrown away. This finding suggests that film viewers attributed a positive value to the Guide and perhaps availed themselves of its use at a more convenient time. This conjecture is supported by reports from ticket sales staff that numerous requests for the Guide had been made by film viewers who had not received one, but had learned from other viewers that it had educational value and was available at the ticket counter.

Findings obtained from the school audience study are reported in the following section.

RESULTS – School Audience Study

Appeal of *Dolphins*

After seeing the film, students were asked to rate how interesting or boring *Dolphins* was (See Table 17). Approximately 58.4% of the sample rated the film as either “very Interesting” or “moderately Interesting.” In contrast, 15.9% thought the film was “moderately boring” or “very boring.” Approximately 25.8% of the students reported the appeal of the film as being “Okay.” On average, responses to *Dolphins* were positive, as indicated by students rating of the film’s appeal as 3.7 on a five-point Likert scale ranging from 1 (very boring) to 5 (very interesting).

Table 17. Rating of Appeal of *Dolphins* by Students

Variable	N	Categories	Percent*
Appeal	132	Very Interesting	28.8%
		Moderately Interesting	29.6%
		Okay	25.8%
		Moderately Boring	10.6%
		Very boring	5.3%

*Percentages sum to 100.1 %, as a result of rounding.

Chi-square analyses revealed that appeal ratings were independent of treatment, gender, ethnicity, estimated prior knowledge about the film’s topics, and prior interest in learning about the films topics. However, there was a significant difference in appeal ratings between schools ($\chi^2(8, n = 132) = 23.38, p \leq .0029$). Table 18 presents the percentages of appeal ratings endorsed by students in each of the three participating schools. Note that, on average, the appeal rating of the New York sample (mean = 4.16) is highest and the appeal rating of the Florida sample (mean = 3.05) is lowest. When interpreting these results, consideration should be given to the conjecture that students in Florida, who are probably the most likely of the three groups to have a familiarity with information about dolphins, would be more critical of a film about dolphins than students in New York, who most likely have the least exposure to dolphins, of the three sample groups.

Table 18. Mean Ratings of Appeal of *Dolphins* by School

Variable	N	Categories	Number (Percentage)		
			Rochester NH (n = 51)	Clifton Park NY (n = 43)	Hollywood FL (n = 38)
Appeal	132	Very Interesting	17 (33.3%)	19 (44.2%)	2 (5.3%)
		Moderately Interesting	14 (27.5%)	14 (32.6%)	11 (29.0%)
		Okay	10 (19.6%)	8 (18.6%)	16 (42.1%)
		Moderately Boring	7 (13.7%)	2 (4.7%)	5 (13.2%)
		Very Boring	3 (5.6%)	0 (0.0%)	4 (10.5%)
Avg. = 3.67			Avg. = 4.16	Avg. = 3.05	

What Students Like Most About *Dolphins*

After viewing the film, students were asked what they liked most about *Dolphins*, and why. All but 4 students responded to this question. Of the entire sample of 132 students, 5 (3.8%) reported that they liked everything about *Dolphins*. Other responses were sorted into the categories presented in Table 19. The five most liked film elements were cinematography (11.4%), the experiential qualities of the film (10.6%), the beauty

of dolphins (9.9%), the IMAX experience (8.3%), and scientific research (7.6%). Other especially liked film elements are the film's positive educational value (6.1%), the scenery (5.3%), special effects and graphics (5.3%), and seeing/learning about dolphin communication (4.6%). Additional feedback and miscellaneous comments are contained in the table below.

Table 19. What Students Like Most About *Dolphins*

<i>Categories</i>	<i>N</i>	<i>Examples of Responses</i>
Cinematography	15	"It showed a lot of well done footage of dolphins." "Good cinematography." "The beautiful pictures because I like seeing them."
Experiential qualities of the film	14	"I like how you felt that you were swimming with the dolphins when you were watching the movie." "It was a great experience."
The beauty of dolphins	13	"I liked watching them because they are really beautiful and I liked learning about them." "Pictures of dolphins because dolphins are so beautiful." "I liked the dolphins because they are cute."
IMAX experience	11	"It was 3-D because things were more realistic." "I liked that it was an IMAX movie because you feel like you are moving."
Scientific field research	10	"I liked seeing how they did their research because I am interested in science and how people do their research." "I liked the different stories about scientists."
Positive educational value	8	"I liked all the interesting facts because they are new things to me." "It explained a lot. It covered most areas that people want to know about dolphins." "We learned a lot about dolphins. Now I know more." "It told many facts about dolphins. I understand them more." "The in-depth facts because I learned things." "I liked how they explained echolocation."
Scenery	7	"I like the scenery. It was pretty." "The scenery because it was peaceful.."
Special effects and graphics	7	"Liked the graphic in the film and the techniques used." "I liked the special effects because they looked real." "The animation because it was cool looking." "I liked the animated map."
See and learn about dolphin communication	6	"Learning about the way they communicate because it is interesting." "I liked the different signals that dolphins make. It's interesting to know what they mean."
The film's sound track	5	"The sound was good." "The sound and music were great."
See and learn about dolphin intelligence	5	"I liked how smart they were." "I liked that parts about dolphin intelligence." "Doing tricks that show how smart they are."
Interaction between Dean and Jojo	4	"I liked the friendship between dean and Jojo." "I liked that the guy came back and spent time with the dolphin because it was so sweet."
Aerial photography	4	"I liked the parts when they flew over the dolphins." "I liked when the camera went over land."
Miscellaneous comments	9	(Responses are listed below.)

The following miscellaneous comments regarding what was liked about *Dolphins* are listed below to guide future planning decisions:

- “I liked all of it because it was never boring and always interesting.”
- “I liked that it was neat, it was neat because it was.”
- “The movie was very interesting.”
- “The echolocation.”
- “The people because of Pierce Bronson.”
- “I like how they sleep with one eye open and one eye open.”
- “I didn’t know there was spotted dolphins.”
- “It’s not every day you come face-to-face with wild dolphins.”
- “It was fun.”

What Students Do Not Like About *Dolphins*

After the film, students were also asked what they did not like about *Dolphins*, and why. Of the 132 students in the sample, 35 (26.5%) reported that they liked everything about *Dolphins*. Responses indicating a disliked feature were sorted into categories presented in Table 20. A total of 6 (4.6%) of the comments received indicated that the student didn’t like anything about the film. An equal number of students 14 (10.6%) expressed the feelings that they didn’t like seeing dolphin caught in a net or motion discomfort. Other respondents felt that Dean and Jojo are not interesting (3.8%), the film is too short (3.0%), and the film is too long (2.3%). An additional 21 miscellaneous comments are included after the table below.

Table 20. What Students Liked Least About *Dolphins*

<i>Categories</i>	<i>N</i>	<i>Examples of Responses</i>
Seeing dolphins caught in a net	14	“I did not like the part when you showed the fishing people because I felt bad for the dolphins, but I thought the movie was great.” “When the dolphins got stuck in the nets. When you saw the really hurt dolphins, because it was sad.”
Motion discomfort	14	“I didn’t like the way the screen moved because it gave me motion sickness.” “The way the camera moved made me dizzy.” “It made me nauseous.”
Excessive dialogue	12	“The talking for minutes at a time.” “The parts of just people talking.” “The talking because it was boring.”
Parts of the film were not interesting	10	“I did not like the shoot of the film in the schoolroom, it was boring.” “I didn’t like the part where they were showing the kids because it was boring.” “I didn’t like how some people were just in the screen because it was boring.”
Dean and Jojo are not interesting	5	“It showed to much about the guy and his dolphin ‘friend’.” “Jojo and the guy, it was boring.” “The man in the speedo!”
The film is too short	4	“The movie was too short.” “This film was kind of short.” “It was too short.”
The film is too long	3	“It was really long.” “It was long.” “Too long.”
<i>Miscellaneous comments</i>	21	(Responses are listed below.)

The following miscellaneous comments regarding what was not liked about *Dolphins* are listed below to further guide future planning decisions:

- *"The end, it wasn't that great near the end."*
- *"It wasn't fast pace, I guess. It didn't have a lot of excitement."*
- *"I didn't like it because all of it was about people."*
- *"I didn't like when the people were talking about their life."*
- *"I didn't like that a narrator talked in it instead of the people."*
- *"I felt that it was not very fun to listen to. It needed to be more fun and not so serious."*
- *"When it wasn't like virtual and you didn't feel like you were in it and when they talked."*
- *"I didn't like that there wasn't a lot of adventure."*
- *"It repeated certain things over again."*
- *"It had no point."*
- *"I did not like the part where they show sharks."*
- *"The movie jumped around a lot."*
- *"I didn't like that it didn't show much about computers because scientists will probably be using computers a lot more in the near future."*
- *"Them trying to find out about if they talk."*
- *"It wasn't natural enough."*
- *"I did not like the amount of time"*
- *"It made me sleepy."*
- *"They could of showed more Orcas."*
- *"The scientists, I have no idea why!"*
- *"They could have done more with the movie."*
- *"It didn't feel like you were moving as much as other movies."*

What Surprises Students

In order to capture unplanned appeal effects, the post-viewing sample was asked to complete the sentence stem, "I was surprised" Approximately 21.2% of the sample wrote no answer to the question. Responses were sorted with keywords and the number of responses in each mutually exclusive category are presented in Table 21. Approximately 20.5% of the 132 students in the sample were surprised by the IMAX experience. Another 9.9% were reportedly surprised by the interaction between dolphins and humans. The strong positive educational value of the film surprised 8.3% of the respondents. Dolphin vision surprised 6.1% of the students. An equal percentage of respondents (4.6%) were surprised by the quality of the soundtrack/ music and by dolphin aggressiveness. Other respondents were surprised that *Dolphins* would be such an interesting film (3.8%), by dolphin jumping ability (3.0%), and by the quality of the films special effects (1.5%). Another 1.5% of the sample reportedly thought that some parts of the film were not interesting. Miscellaneous comments offered by students are included after the table on the following page.

Table 21. Students' Completion of "I was surprised . . ."

Categories	N	Examples of Responses
IMAX experience	27	"that the dolphins came out of the screen." "you felt like you were in the movie." "how big the screen was."
Interaction between dolphins and humans	13	"by how attached they get with some people." "by how dolphins acted around humans." "that dolphins like people in the water." "how friendly some dolphins can be."
Positive Educational value	11	"because it taught us a lot about dolphins and I didn't know if it would." "how much I didn't know about dolphins and learned from the film." "at how much information I learned."
Dolphin intelligence	9	"by the way dolphins learn things." "at how smart dolphins are." "by how dolphins could read."
Dolphin vision	8	"that they can see in two directions." "that dolphins sleep with one eye open."
Quality of soundtrack	6	"by how good the music sounded." "by the music and sound." "at all of the sound effects."
Dolphin aggressiveness	6	"that dolphins are so aggressive." "that dolphins will be aggressive to other dolphins." "that dolphins can be viscous."
The film is interesting	5	"because I didn't expect it would be so good. Really interesting film." "that it was a really interesting movie." "how interesting the film was."
Dolphin jumping ability	4	"to see how high they jump." "when they flipped in the air."
Special Effects	2	"to see the good special effects." "the special effects."
Parts of the film were not interesting	2	"that it was not interesting." "it was boring."
Miscellaneous comments	11	(Responses are listed below.)

The following are miscellaneous comments offered by students describing what elements of their viewing experience surprised them:

- "by the amazing pictures."
- "when the map piece tore off and actually became a real island."
- "the film was totally focused on dolphins."
- "that dolphins live in groups."
- "that dolphins are what we would be if we lived in the water."
- "that so many dolphins died in tuna nets."
- "to find out how many different types of dolphins there are."
- "that they had so many feelings, and showed them."
- "on how dolphins communicate."
- "how fast they are."
- "that Pierce Bronson was the narrator."

What Most Disappoints Students

Students also completed the sentence stem: "I was most disappointed. . ."

Responses to this item were received from 88 (66.7%) of the 132 students in the sample. A total of 24 (18.2%) of the entire sample reported that nothing about *Dolphins* is disappointing. Similarly, 5 (3.4%) of the respondents indicated that the only thing that disappointed them was when the film ended. Responses actually indicating a disliked feature were sorted into the categories presented in Table 22. Of the 132 sample students, 20 (15.2%) indicated that the harm done to dolphins by humans and sharks is disappointing. Another 10 (7.6%) reported that some parts of the film were not interesting. Other students (6.8%) felt that the film is too short. A similar percentage of students (1.5%) were disappointed by what they feel is excessive dialogue in the film, too little known by scientists about dolphin communication, not enough aerial scenes, and dolphin aggressiveness. An additional 12 miscellaneous comments are included after the table below.

Table 22. Students' Completion of "I was most disappointed. . ."

<i>Categories</i>	<i>N</i>	<i>Examples of Responses</i>
Harm done to dolphins	20	"that dolphins are cut by motor boats." "that they get hurt by sharks." "when I saw dolphins in the net."
Parts of the film were not interesting	10	"that it wasn't more interesting." "it was kind of boring and loud." "that is was boring."
The film is too short	9	"that the film was short." "that it was so short." "because it was short."
Excessive dialogue	2	"about how much talking went on." "when the guy kept talking."
Too little known about dolphin communication	2	"that humans have not found a way to communicate with dolphins." "that the lady didn't find out how to talk to dolphins."
Not enough aerial scenes	2	"how there wasn't much flying in the air." "we didn't fly long enough."
Dolphin aggressiveness	2	"that the dolphins sometimes attack people." "that dolphins can be violent."
<i>Miscellaneous comments</i>	12	(Responses are listed below.)

The following miscellaneous comments were offered by students describing what elements of their viewing experience most disappointed them:

- "When they only showed tame dolphins and not wild ones."
- "That they didn't show more of the freshwater dolphins."
- "When it showed the classroom."
- "When the guy left the dolphins."
- "That this movie showed too much about the guy and his dolphin 'friend'."
- "When the part about the cameras flying off cliffs ended."
- "When they cut away from the dolphins."
- "In the picture with black dots all over."
- "Was not natural enough."
- "In the little black dots that came on the screen."
- "By the seriousness of the video."
- "That Pierce Bronson wasn't in the movie."

Interest in Learning More About Dolphins

Before and after viewing the film, students were asked to rate, on a 5-point Likert scale ranging from 1 (not interested) to 5 (very interested), how interested they were in learning more about dolphins. As specified in Table 23, the pre-viewing interest mean is 2.27 and the post-viewing interest mean is 2.86. Note that higher means are associated with more interest in learning about dolphins and lower means are associated with less interest.

Table 23. Interest in Learning More About *Dolphins* by Student
[Number of Students (Percentage)]

			1	2	3	4
	N	Mean	<i>Not Interested</i>	<i>A Little Interested</i>	<i>Moderately Interested</i>	<i>Very Interested</i>
Pre-viewing interest	132	2.27 (SD = 1.0)	37 (28.0%)	42 (31.8%)	33 (25.0%)	20 (15.2%)
Post-viewing interest	132	2.86 (SD = 0.9)	6 (4.6%)	39 (29.6%)	54 (40.9%)	33 (25.0%)

An ANOVA with interactions and nested factors were calculated for pre/post mean interest rating with Treatment as a factor. Treatment was found to be significant, $F(1, 125) = 3.14, p \leq 0.0278$. Consequently, seeing the film and doing the classroom activities contained in the *Dolphins Teacher's Guide* had a significant positive impact on students' interest in learning more about dolphins. Student interest in learning about dolphins did not differ significantly with respect to school location (i.e., NH, NY, FL).

Personal Associations or Connections With the Film

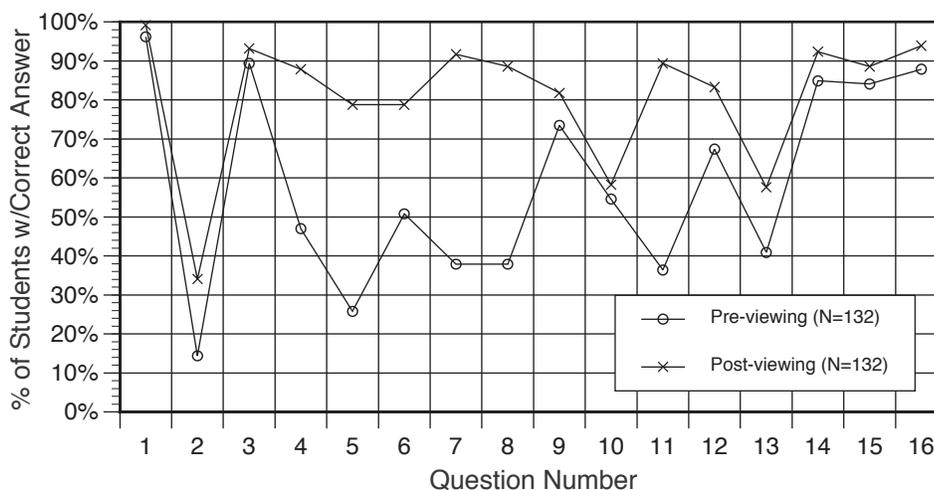
After viewing the film, students were asked if the film reminded them of anything they previously knew or experienced. Of the 132 students in the sample, 23 indicated that it had. A total of 17 respondents described the association/connection. The following are their written responses:

- "Flipper."
- "I was in Florida looking for sand dollars with my uncle and a dolphin came up to us and started making sounds."
- "Going to the Florida Keys and swimming with/around dolphins."
- "In Florida when I go speed boating, dolphins always ride the waves."
- "It reminded me of when I went to Sea World."
- "When we did the Learning Fair."
- "It reminded me about the one eye shut and the other eye open."
- "When I went to see dolphins do tricks, etc."
- "Dolphins travel as much as 50 miles a day."
- "An IMAX film on sharks."
- "I knew already that dolphins were one of the smartest animals."
- "That they were very smart."
- "Echolocation."
- "Of how they speak to each other and find their food and how they give birth, etc."
- "Brazil."
- "Different countries."
- "Mammals."

Learning Outcomes

Understanding of the film's content was assessed via a 16-point, true/false item test. Figure 2 shows the distribution of the students' achievement scores for each content question on both pre-viewing and post-viewing surveys. The pre-viewing mean achievement score for the student sample is 9.29 and the post-viewing mean score is 12.98. An analysis of variance indicated that the means are significantly different, $F(1, 131) = 250.33, p \leq 0.0001$. Thus, the learning outcomes resulting from viewing *Dolphins* are statistically significant.

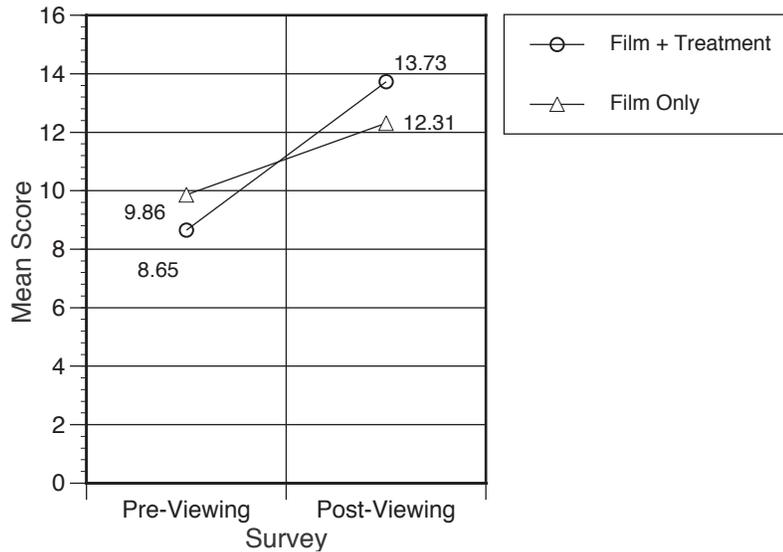
Figure 2. Distribution of Test Scores by Question for Pre- and Post-Viewing Surveys



With an interest in interaction effects, ANOVAs with interactions and nested factors were calculated for Survey (i.e., Pre, Post) and individual demographic/background variables of Treatment, Interest in learning more about dolphins, Gender, and School. One interaction was significant: Treatment (FILM, ACTIVITY + FILM), $F(1, 130) = 41.20, p \leq 0.0001$.

To examine the interaction (*Survey by Treatment*), Figure 3 presents the mean scores for the pre- and post-viewing content questions by the two treatment categories (FILM, ACTIVITY + FILM). On average, there was a significant improvement in learning performance for both the students who viewed the film and performed project activities ($F(1, 61) = 506.89, p \leq 0.0001$) and the students who only viewed the film ($F(1, 69) = 55.93, p \leq 0.0001$). However, the increase in scores for the students who viewed the film and performed project activities (5.08 points) is generally double the increase in scores of the students who only viewed the film (2.45 points). Having performed the activities contained in the *Dolphin's Teacher's Guide* did have a significantly positive impact on students' knowledge of film content. There is no significant difference in pre-viewing scores across the three participating schools. Similarly, there is no significant difference in post-viewing scores across the schools.

Figure 3. Distribution of Mean Achievement Scores for Pre- and Post-Viewing Surveys



With regards to specific content areas in which knowledge increased, statistically significant improvement between the pre- and post-viewing was evidenced for 9 of the 16 content questions (See Table 24). The items for which this improvement is not demonstrated are:

1. Dolphins are mammals.
2. Dolphins usually live in social groups
3. Dolphins may communicate more often when the water is clear.
4. Dolphins can look up with one eye and back with the other.
5. Dolphins do not breath through gills.
6. A dolphin's brain is larger than a dog's brain.
7. Dolphins can get caught I a fishing net.

When interpreting these results, it is important to note that for all of these items, except for the fourth (i.e., independent eye movement), the pretest score was very high. Hence, there was only marginal room for improvement, and the probability that any post-test improvement would attain statistical significance is unlikely. Students most likely learned this information from associated class assignments prior to their fieldtrip to view *Dolphins*.

Note that approximately half of the student sample responded correctly to the question about independent eye movement, most likely reflecting guessing on this true-or-false item. Consequently, this piece of information appears to have alluded these students.

Table 24. Number and Percentage of Correct Responses

<i>Content Item</i>	<i>Pre-Viewing (% of Students)</i>	<i>Post-Viewing (% of Students)</i>	<i>Fisher's Exact Test</i>
Dolphins are mammals.	127 (96.2%)	131 (99.2%)	ns
Dolphins live in every sea on Earth.	19 (14.4%)	45 (34.1%)	= .0003
Dolphins usually live in social groups.	118 (89.4%)	123 (93.2%)	ns
Echolocation permits dolphins to find food in the sand.	62 (47.0%)	116 (87.9%)	≤ .0001
Jumping allows dolphins to see birds five miles away.	34 (25.8%)	104 (78.8%)	≤ .0001
Dolphins can read sign language better than chimpanzees can.	67 (50.8%)	104 (78.8%)	≤ .0001
Dolphins are not always friendly to humans.	50 (37.9%)	121 (91.7%)	≤ .0001
Some sharks attack and eat dolphins.	50 (37.9%)	117 (88.6%)	≤ .0001
Dolphins may communicate more often when the water is clear.	97 (73.5%)	108 (81.8%)	ns
Dolphins can look up with one eye and back with the other.	72 (54.6%)	77 (58.3%)	ns
Dolphins obtain food using organized teamwork.	48 (36.4%)	118 (89.4%)	≤ .0001
Dolphins are able to sleep with one eye open.	89 (67.4%)	110 (83.3%)	= .0041
Some dolphins live in fresh water rivers.	54 (40.9%)	76 (57.6%)	= .0096
Dolphins do not breath through gills.	112 (84.9%)	122 (92.4%)	ns
A dolphin's brain is larger than a dog's brain.	111 (84.1%)	117 (88.6%)	ns
Dolphins can get caught in a fishing net.	116 (87.9%)	124 (93.9%)	ns

* Not statistically significant

To gain insight into additional knowledge gained, students were also asked if they learned anything about dolphins that they did not know before viewing the film. If so, they were asked to specify what they had learned. Of the 132 students in the sample, 117 (88.6%) reported they had learned something new. A total of 106 went on to describe what they had learned. All responses to this item were sorted with keywords, and percentages of each mutually exclusive category are shown in Table 25, on the following page. Note that the percentages were calculated based on the possibility of receiving a written comment from each of the 132 sample students.

Table 25. General Ideas/Facts Students Reported Learning From Film

<i>Type of Information Learned</i>	<i>Number (% of entire sample)</i>
Information associated with:	
• Dolphin vision	28 (21.2%)
• Dolphin communication	16 (12.1%)
• Dolphin intelligence	14 (10.6%)
• Echolocation	8 (6.1%)
• Interaction with humans	6 (4.6%)
• Scientific field research	5 (3.8%)
• Dolphin eating behavior	4 (3.0%)
• Dolphin sleeping behavior	4 (3.0%)
• Dolphins living in fresh water	3 (2.3%)
• <i>Miscellaneous information</i>	18 (13.6%)
<i>Total</i>	<i>106 (80.3%)</i>

Approximately 21.2% of the sample learned information about dolphin vision. About 12.1% reported learning information about dolphin communication. Another 10.6% of the sample said that they learned information about dolphin intelligence. Approximately 6.1% indicated that they learned about dolphin echolocation. Information about interaction with humans was reportedly obtained by 4.6%. About 3.8% indicated they found the film to be a useful resource for information about scientific field research. A similar percentage (3.0%) learned about eating jumping and sleeping behavior. Other members of the sample learned that some dolphins live in freshwater rivers (2.3%). The following sample of miscellaneous responses to this inquiry are reflective of students' feeling that they had acquired a large amount of new knowledge:

- "I learned tons of things."
- "I really learned a lot about dolphins."
- "A learned a lot."
- "New facts."
- "I learned answers to the first survey."
- "I learned everything that you asked about."
- "I learned the answers to many of the questions on page two [content questions]."
- "Many general facts."
- "I learned about everything in the film."
- "I learned everything."

Summary of Findings

The following is a summary of findings obtained from both the adult and school audience studies:

Adult Audience Study

- *To what extent does *Dolphins* appeal to adult viewers?*

Approximately 79.2% of the adult sample rate *Dolphins* as “Very Interesting.” Another 14.6% rate the film as “Moderately Interesting.” Additionally, viewers were asked to rate how visually interesting or visually boring the film is, as well as the film’s level of entertainment. On a five-point Likert scale, the mean visual interest rating is 4.65, and the film’s level of entertainment obtained an average rating of 4.34. Viewers generally perceive the film’s pace to be suitable. Similarly, the post-viewing sample feels that the amount of facts presented in *Dolphins* is appropriate. Appeal ratings were found to be independent of gender, age group, education, and number of IMAX® films ever seen

- *Does the film meet viewer expectations?*

Prior to viewing *Dolphins*, the four categories of content that sample audience members most expect to be presented in the film are general information about dolphins, scenes and information about dolphin habitats, ocean/underwater scenery, dolphin social behavior. Subsequent to seeing the film, 97.0% of the post-viewing sample who reported having had expectations prior to seeing the film indicated that the film had either met or exceeded their expectations.

- *What do viewers like most about *Dolphins*?*

The four categories of content sample audience members reported liking most about *Dolphins* are the film’s cinematography/photography, the film’s positive educational value, the experiential qualities of the film, and the beauty of dolphins.

- *What do viewers like least about *Dolphins*?*

Of the viewers who responded to this inquiry, 39.8% commented that they like everything about the film. Responses indicating a disliked feature focused primarily on what is reported to be insufficient educational content, images that move too rapidly on the screen, discomfort with seeing dolphins injured or caught in a net, and too short a film.

- *What surprises viewers most about *Dolphins*?*

The four categories of film content that most surprises viewers are dolphin intelligence, dolphin gentleness, high quality cinematography, and dolphin vision.

- *What most disappoints viewers?*

The four categories of film content that most disappoints viewers focus primarily on what is reported to be discomfort seeing dolphins injured or caught in a net, insufficient educational content, too short a film, and too few types of dolphins are shown and discussed.

- *What most confuses viewers?*

Only six people in the 212 member post-viewing sample reported finding anything confusing about *Dolphins*. The following explanations about the confusing components are direct quotations from these members of the sample:

- “How long were the scientists able to stay underwater?”
- “How did the people breath under the water?”
- “When the female researcher comes up for air and shouts stats to the other girl.”
- “Mentioned dolphins call each other by name, but then didn’t explain.”
- “The different types of dolphins and how do they differ, or do they?”
- “There is a part where a scientist in the Bahamas is diving. She tells other scientists in the boat something about the dolphin that I really couldn’t get.”

- *What are the learning outcomes associated with viewing Dolphins?*

Viewing the film significantly increased adult viewers’ knowledge about topics associated with dolphins. The pre-viewing mean test score is 10.18 out of a possible 16 points compared with the significantly higher post-viewing mean score of 14.45. These scores do not show interactions with any of the demographic or background variables measured.

With regards to specific content areas in which knowledge increased, statistically significant improvement between the pre- and post-viewing respondents is evidenced for 14 of the 16 content questions. The two items for which this improvement is not demonstrated are: (1) “Dolphins usually live alone rather than in groups” and (2) “Dolphins may communicate more often when the water is clear.” When interpreting these results, it is important to note that for the first of these items, the pretest score was so high, the probability that any post-test improvement would attain statistical significance is unlikely. The fact that dolphins usually live in social groups appears to be common knowledge.

In contrast, for the second item that did not garner demonstrable improvement, approximately half the members of the pre-viewing and post-viewing samples responded correctly, most likely reflecting guessing on this true-or-false item. Consequently, the scientist’s observation that dolphins may communicate more often when the water is clear alluded the sample viewers.

- *What is the impact of the Dolphins Family Fun Guide?*

The *Dolphins Family Fun Guide* was distributed by ticket staff to individuals who purchased a pass to see *Dolphins*. A total of 39 pre-viewing respondents and 48 post-viewing respondents reported that they had read and/or performed activities contained in the *Guide* prior to viewing the film. While there is not a significant difference between the scores of Guide and non-Guide users, there is a consensus of opinion that it is both interesting and informative. Periodic examinations of trash receptacles throughout the theater and museum facilities revealed that only a very few of the approximately 500 Guides that were distributed over the course of this study had been thrown away. This finding suggests that film viewers attributed a positive value to the Guide and perhaps availed themselves of its use at a

more convenient time. This conjecture is supported by reports from ticket sales staff that numerous requests for the Guide had been made by film viewers who had not received one, but had learned from other viewers that it had educational value and was available at the ticket counter.

School Audience Study

- *To what extent does Dolphins appeal to student viewers?*

Of the 132 student viewers participating in this study, 58.4% of the sample rated the film as either “Very Interesting” or “Moderately Interesting.” On average, responses to *Dolphins* were positive, as indicated by students’ rating of the film’s appeal as 3.7 on a five-point Likert scale ranging from 1 (very boring) to 5 (very interesting). Appeal ratings were independent of treatment, gender, ethnicity, estimated prior knowledge about the film’s topics, and prior interest in learning about dolphins.

- *What do students like most about Dolphins?*

The four categories of content the student sample reported liking most about *Dolphins* are the film’s cinematography / photography, the experiential qualities of the film, the beauty of dolphins, and the IMAX experience. The fifth category of content most liked by students, and of special interest to this project, is scientific field research, as illuminated by the stories about scientists and their research.

- *What do students like least about Dolphins?*

Of the students who responded to this inquiry, 26.5% commented that they liked everything about the film. Responses indicating a disliked feature focused primarily on seeing dolphins injured or caught in a net, an experience of motion discomfort, excessive dialogue, and low interest value in some parts of the film (no descriptions offered).

- *What surprises students most about Dolphins?*

The four categories of film content that most surprised members of the student sample were the IMAX experience, the interaction between dolphins and humans, positive educational value of the film, and dolphin vision.

- *What most disappoints students?*

Of the students who responded to this inquiry, 27.3% commented that they liked everything about the film. Another 5.6% of the responses indicated that the only thing that was disappointing was when the film ended. Responses indicating disappointment focused primarily on the harm that’s inflicted on dolphins by humans and sharks, low interest value in some parts of the film (no descriptions offered), the shortness of the film, and excessive dialogue.

- *What impact does the film have on students interest in learning more about dolphins?*

Measured on a five-point Likert scale ranging from 1 (not interested) to 5 (very interested), students’ pre-viewing interest mean is 2.27 and the post-viewing interest mean is 2.86. An analysis of variance revealed that seeing the film and doing the classroom activities contained in the *Dolphins Teacher’s Guide* had a significant positive impact on students’ interest in learning more about dolphins.

- *Do students have any personal associations or connections with film content?*
After viewing the film, students were asked if the film reminded them of anything they previously knew or experienced. Seventeen respondents offered a variety of recollections.

- *What are the learning outcomes associated with students' viewing of Dolphins?*
Viewing the film significantly increased students' knowledge about topics associated with dolphins. The pre-viewing mean test score was 9.29, out of a possible 16 points, compared with a significantly higher post-viewing mean score of 12.98.

With regards to specific content areas in which knowledge increased, significant improvement between the pre- and post-viewing surveys is evidenced for 9 of the 16 content questions. The items for which this improvement is not demonstrated are:

1. Dolphins are mammals.
2. Dolphins usually live in social groups
3. Dolphins may communicate more often when the water is clear.
4. Dolphins can look up with one eye and back with the other.
5. Dolphins do not breath through gills.
6. A dolphin's brain is larger than a dog's brain.
7. Dolphins can get caught I a fishing net.

When interpreting these results, it is important to note that for all of these items, except for the fourth (i.e., independent eye movement), the pretest score was very high. Hence, there was only marginal room for improvement, and the probability that any post-test improvement would attain statistical significance is unlikely. Students most likely learned this information from associated class assignments prior to their fieldtrip to view *Dolphins*.

Approximately half of the student sample responded correctly to the question about independent eye movement, most likely reflecting guessing on this true-or-false item. Consequently, this piece of information appears to have alluded these students.

When asked if they had learned anything about dolphins that they did not know before viewing the film, 88.6% of the students reported that they had. The six most frequently cited learning categories are information associated with

- Dolphin vision
- Dolphin communication
- Dolphin intelligence
- Echolocation
- Interaction with humans
- Scientific field research

- *Does performance of Teacher's Guide activities following film viewing affect outcomes?*
An analysis of variance revealed that, on average, there was a significant improvement in learning performance for students in both treatment groups (i.e., students who viewed the film and performed Teacher's Guide activities vs. students who only viewed the film). However, the increase in scores for the students who viewed the film and performed project activities (5.08 points) is generally double the increase in scores of the students who only viewed the film (2.45 points). Performing the activities contained in the *Dolphin's Teacher's Guide* does have a significantly positive impact on students' knowledge of film content.

References

Campbell, D. T., & Stanley, J. C. (1966). Experimental and quasi-experimental designs for research. Reprinted from N. L. Gage (Ed.), Handbook of Research on Teaching. Chicago, IL: Rand McNally.

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