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ABSTRACT

The Search for Solutions (SFS) film series has been a popular and important component of many school science programs ranging from elementary to college level. Phillips Petroleum Corporation, funding agent for the SFS, reported that by 1984 some 26,000 schools, 83 percent of all public and private schools, had used the series. In addition, some 84 million students had viewed the films prior to January 1984. The continued popularity of the SFS series attests to its perceived effectiveness on the part of teachers. However, it is not clear just what effects on students, both in terms of achievement and attitudes, result from the series. In addition, many strategies have been developed by teachers to use this series. This evaluation was designed to assess teacher perceptions resulting from the use of the SFS series and to further determine various instructional strategies and their effectiveness. Items discussed include the background of the program, the survey development and administration, and qualitative and quantitative findings of the survey. A copy of the survey is included. (Author/MVL)

AN EVALUATION OF

THE SEARCH FOR SOLUTIONS FILM SERIES:

A NATIONAL SURVEY

KANSAS STATE UNIVERSITY

The Center for Science Education

AN EVALUATION OF THE SEARCH FOR SOLUTIONS FILM SERIES: A NATIONAL SURVEY

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A paper presented at the Association for the Education of Teachers of Science Annual Meeting, St. Louis, MO: April, 1988.

Introduction

The Search for Solutions (SFS) series has been a popular and important component of many school science programs ranging from elementary to college level. Phillips Petroleum Corporation, funding agent for the SFS, reported that by 1984 some 26,000 schools, 83 percent of all public and private schools, have used the series. In addition, some 84 million students had viewed the films prior to January, 1984. The continued popularity of the SFS series attests to its perceived effectiveness on the part of teachers. However, it is not clear just what effects on students, both in terms of achievement and attitudes, result from the series. In addition, over the years many strategies have been developed by teachers to utilize this series. This evaluation endeavor was to assess teacher perceptions resulting from the use of the "Search" series and to further determine various instructional strategies and their effectiveness.

Background

The series was developed to pique interest in science and middle school students. Secondly, it was designed to encourage new questions on the part of students. The specific aims were to present science as a study of processes, take a look at failures in science, develop the idea that scientists are persistent, illustrate the joy of discovery, foster an interest in lifelong learning of science, and develop problem solving skills. These objectives are indeed worthwhile, but have they been met? The purpose of this study is to answer that question. In addition, teachers have the ability to use any educational program in a multitude of ways - some are effective and some are not. An additional purpose of this study will be to find out how teachers use the "Search."

Ames (1984) noted that the intent of the films was a response to the following metaphorical analogy:

> "...students are not responding to math and science instruction because they are not able to see how the "game" is played. They are only being taught the rules. Imagine not being allowed to play the game - or even witness the play. Under such conditions even the most devoted fans would lose interest (Ames, 1984, p. 15)."

The nine documentary-style films focus on a variety of scientific concepts. The series takes a global look at the everyday experiences as it follows scientists, statesmen, and others who have tackled science or science-related problems. Program titles are "Investigation", "Evidence", "Patterns", "Adaptation", "Context", "Trial and Error", "Modeling", "Theory", and "Prediction".

SURVEY DEVELOPMENT AND ADMINISTRATION

The Search for Solutions Survey (SSS) was developed consistent with the goals of the Search program development. A copy of the survey is provided in Appendix A. The survey is composed of five parts and a demographic questionnaire. Part I assessed the use of the films and teachers' guide. Part II assessed the impact of the films on students within the context of the developers objectives. Part III was concerned with the success of the films in terms of reaching the goals of the developer. Part IV was a series of open-ended questions. Part V provided an opportunity for teachers to record frequency of use, quality of production, and appropriateness by each film title.

The SSS was field tested by sending it to ten middle school teachers. Comments and criticisms were solicited and revisions were made. In addition, the ten field testers were asked to respond to a content validity instrument regarding clarity, understanding, relevance, and representativeness of the items. These judges rated the items with 91% agreement.

The Sample

A stratified random sample of middle school science teachers was obtained from the SFS film distributor. Surveys were sent to 728 search users. The sample was broken down by state and user type. User types were regular users, occasional users, new users, and restart users. Three-hundred-sixty-four surveys were returned.

Quantitative Results

Data collected from the teachers concerning the SFS films revealed a great deal of information regarding the demographics of the teachers in general. Approximately 13% of the teachers responding to the survey were in their first five years of teaching, while nearly 27% had taught for more than 20 years. Interestingly though, the model group for teacher ages was 31-40 years. Another 33% of the teachers responding in the sample were between 41 and 50 years of age.

Most of the teachers, 60%, reported more than 40 hours of academic course work beyond the bachelor's degree. This figure would tend to indicate that most of the teachers have completed master's degrees. Over two-thirds of the sample respondents were men.

A large percentage, 44%, of the teachers reported that their major teaching responsibility was in the area of the life sciences. The physical sciences were reported as a major teaching responsibility by an additional 30% of the respondents. Approximately two-thirds of the respondents also reported that they do not teach courses other than science. The above information is shown in Table 1. In addition, this table shows the number of years that the SFS films have been used, the type of classes in which the films are being used, and the number of films used by the respondents.

Information was also collected regarding the type of use for the SFS films. Most teachers reported that they "frequently" used the films to "provide general scientific information." There was not a clear pattern from the teacher responses as to when the films were used in the teaching of given information. Most of the respondents reported using the films to both introduce and to summarize lessons on a "frequent" basis. For the most part, the films were only used once with a given class and their main function was "enrichment" of the lesson.

Teachers were generally in agreement that the films were successful in having an impact on students. There was, for instance, general strong agreement that the material in the films was presented in an interesting manner, was valuable for the students, and that the students liked the films. Respondents were less certain that the films made students want to study science more or that the films fostered an interest in science careers. This information is presented in Table 3.

With regard to the goals of the films, respondents were in agreement that the films showed that science is a study of processes, that success and failure are a part of science, and that persistence is a characteristic of scientists. This information is shown in Table 4. Finally, the teachers were asked to rate the Search for Solutions films. The ratings showed only a remarkable degree of similarity in the films. Trial and Error was the slight favorite in terms of both quality of production and appropriateness for students when considering the sample means.

Qualitative Findings

In order to probe beyond the questions and response categories of Parts I, II, III, and V of the survey, five open-ended questions were developed. Although many respondents left one or more of these questions blank, several comments were held in common. Certainly, these questions allowed an opportunity for teachers to respond in a way that is useful to the film developers and teacher educators. All surveys (364) were analyzed using a content analysis procedure that broke down responses in to categories. These categories were scanned for commonality and relationships. Resultant data appears in Tables 6 through 10.

Summary

As predicted, the SFS series was highly thought of by most middle school teachers. These films represent one of the more significant contributions from the private sector in recent time. The SFS and accompanying teacher's guide provide supplementary material for science teachers that depict the enterprise of science in a most realistic setting. It is critical for students and teachers to observe science in action as a tentative, exciting, and rewarding process since many students may rarely have the opportunity to observe or participate in "real" science.

TABLE 1

Demographic Data Tables: Search for Solutions Survey

Years of Teaching Experience (n=348)	FREQUENCY	PERCENTAGE	CUMULATIVE PERCENTAGE
1 - 5 Years	46	13.2	13.2
6 - 10 Years	58	16.7	29.9
11 - 15 Years	82	23.6	53.4
16 - 20 Years	69	19.8	73,3
> 20 Years	93	26.7	100.0
Age (n=346)			
21 - 30 Years	43	12.4	12.4
31 - 40 Years	129	37.3	49.7
41 - 50 Years	115	33.2	82.9
51 - 60 Years	49	14.2	97.1
> 60 Years	10	2.9	100.0
Academic Background Bachelors Plus... (n=344)			
0 - 20 Hours	58	16.9	16.9
21 - 40 Hours	80	23.3	40.1
41 - 60 Hours	85	24.7	64.8
51 - 80 Hours	50	14.5	79.4
81 - 100 Hours	25	7.3	86.6
> 100 Hours	46	13.4	100.0
Gender (n=345)			
Female	110	31.9	31.9
Male	235	68.1	100.0
Primary Teaching Responsiblity (> 50% of classes) (n=337)			
Life Science	149	44.2	44.2
Physical Science	101	30.0	74.2
Earth Science	45	13.4	87.5
Other	45	12.5	100.0

TABLE 1 (continued)

	FREQUENCY	PERCENTAGE	CUMULATIVE PERCENTAGE
Do You Teach Courses Other Than Science (n=346)			
No	223	64.5	64.5
Yes	123	35.5	100.0
Years Using SFS (n=346)			
0 - 1 Years	109	31.5	31.5
2 - 3 Years	69	19.9	51.4
4 - 5 Years	104	30.1	81.5
> 5 Years	64	18.5	100.0
Type of Class Shown SFS (n=339)			
Regular Classes	310	91.5	91.5
Remedial Classes	9	2.7	94.2
Accelerated Classes	20	5.8	100.0
Number of Films Used (n=348)			
1 to 3 Titles	40	11.5	11.5
4 to 6 Titles	73	21.0	32.5
7 to 9 Titles	235	67.5	100.0

TABLE 2

Use of Search for Solutions Films

	FREQUENCY	PERCENTAGE	CUMULATIVE PERCENTAGE
Used Films to Introduce Activities (n=347)			
Frequently	44	12.6	12.6
Sometimes	213	61.2	73.9
Never	90	26.1	100.0
Used Films to Sum Up Lessons (n=348)			
Frequently	29	8.3	8.3
Sometimes	224	64.4	72.7
Never	95	27.3	100.0
Used Films to Provide General Scientific Information (n=348)			
Frequently	249	71.6	71.6
Sometimes	93	26.7	98.3
Never	6	1.7	100.0
Used the Teacher Guide (n=348)			
With all the films	105	30.2	30.2
With one or more films	187	53.7	83.9
Without the films	2	0.6	84.5
Did not use teacher guide	54	15.5	100.0
Frequency of Film Use (n=348)			
Once per class	295	84.8	84.8
One or more films more than once	44	12.6	97.4
All the films more than once	9	2.6	100.0

TABLE 2 (continued)

Use of Films (n=347)			
Enrichment	295	84.8	84.8
Planned part of lessons	52	15.2	100.0
Do you have your own copy? (n=348)			
Yes	69	19.8	19.8
No	279	80.2	100.0

TABLE 3

Search for Solution Impact on Students

Items	$\bar{X}$	SD	N
These films had a positive affect on my students' attitudes toward science.	4.17	.712	347
After viewing these films my students wanted to study science more.	3.48	.694	347
I feel the content of these films is valuable for my students.	4.43	.638	347
The material in these films is presented in an interesting way.	4.56	.616	346
After viewing these films, students have a better understanding that the knowledge of science is constantly changing and not absolute.	4.25	.621	346
Students expressed an interest in science after viewing these films.	3.71	.779	346
The films illustrate the joy of discovery in science.	4.27	.638	346
The students liked these films.	4.30	.660	346
These films fostered an interest in science as a career (in my students).	3.41	.714	346

TABLE 4

Degree Search for Solutions Goals Met

Items							$\bar{X}$	SD	N
To increase student interest in science:									
Increased a great deal	5	4	3	2	1	Did not increase at all	3.66	.791	346
To encourage students to ask questions:									
Encouraged many questions	5	4	3	2	1	Encouraged few questions	3.80	.863	346
To present science as study of processes:									
Clearly presented	5	4	3	2	1	Not clearly presented	4.18	.766	346
To develop problem solving skills in students:									
Developed very well	5	4	3	2	1	Developed poorly	3.77	.826	346
To show both success and failure as part of science:									
Shows very well	5	4	3	2	1	Shows poorly	4.09	.806	346
To develop persistance as a characteristic of scientists:									
Developed very well	5	4	3	2	1	Developed poorly	4.11	.792	346

TABLE 5

Teacher Ratings of Search for Solutions

	QUALITY OF PRODUCTION		APPROPRIATENESS FOR STUDENTS	
FILM TITLE	$\bar{X}$	SD	$\bar{X}$	SD
Prediction (N=295)	4.49	.633	4.22	.757
Modeling (N=290)	4.46	.660	4.22	.779
Theory (N=290)	4.46	.670	4.16	.766
Evidence (N=293)	4.50	.634	4.25	.801
Patterns (N=283)	4.41	.726	4.18	.809
Investigation (N=284)	4.48	.637	4.25	.733
Adaptation (N=277)	4.43	.665	4.18	.754
Trial & Error (N=282)	4.53	.638	4.32	.749
Context (N=266)	4.40	.667	4.11	.802

5 = Very Good 4 = Good 3 = Undecided 2 = Poor 1 = Very Poor

TABLE 6

Why did you being using the Search for Solutions films?

Most Frequent Comments	Number of Responses
Influence from another teacher	50
Saw advertising about them	40
They are free	31
Enrichment	24
Films show science process	20
Previewed films and liked them	10

Other Comments

* Really liked the way science was applied to modern day Technology to Frisbees, Dallas Cowboys, air sculptures, etc.
* General introduction to science, scientific investigation, and methods
* Introduces various aspects of science
* Lab thinking
* Had seen parts on television
* Love the book...presented a visual for nine facets of science not previously available
* Trying to locate films to use to illustrate many areas of General Science

TABLE 7

How did you originally find out about the Search for Solutions films?

Most Frequent Comments	Number of Responses
Advertising	202
Another teacher	89
Previewed film	15

TABLE 8

What do you see to be Search for Solutions major value for students?

Most Frequent Comments	Number of Responses
Show process of science	72
Motivational, create interest toward science	58
Shows diversity of science, different scientific examples	46
Enrichment	25
Emphasizing scientific method	21
Helps students understand how science works	17
Shows different careers in science	15

Other Responses

* Blend of Art, History, Science, and Inventiveness
* Promote substantive discussion
* Science is not absolute
* Shows discoveries are not always made in laboratories
* Shows there are successes and failures
* Through failures discoveries can be made
* Different approach than our book
* To reinforce my lessons
* Solutions don't come easy
* Shows how to solve problems in everyday life
* Shows joy and interest of scientists
* Intellectual curiosity bears fruit

TABLE 9

How might Search for Solutions films be improved by revision?

Most Frequent Comments	Number of Responses
Improve dialogue and vocal quality	23
Adjust vocabulary and subject to grade level	21
Provide examples of more recent research	16
Make films on same subject matter	16
Less narration and more action	11
Provide more subject matter (deeper)	9
Need better teacher's guide	8
Provide better scene continuity	6
Different and more appropriate music	6
Need more geology and earth science	3

Other Responses

* Increased emphasis on environment
* More hands-on activities
* One film per month
* Improve associated activities
* More emphasis on life sciences
* More emphasis on scientific methods
* Students do-at-home projects should be included
* Incorporated ethical issues
* Films on unsolved problems
* Include biographical information with film
* Include test with films

TABLE 10

Further comments concerning the Search for Solutions films:

Most Frequent Comments	Number of Responses
Need to be updated	32
Want to copy films	9

Other Responses

* Fails to interest AP students
* Should include more material on Geology and Earth Science
* Shows science is universal
* A list of pre and post true/false questions with teachers guide
* Prefer 16 mm - shows larger picture
* Too advanced for middle school
* Wish there were teacher workshops in conjunction with films
* The Newsletter is helpful
* Emphasis green leaves, recyclable non-polluting energy sources; not nuclear waste problems

APPENDIX A

Dear Science Teacher:

We are currently conducting a study among teachers concerning the use and impact of the Search for Solutions series on students. We would very much appreciate your cooperation in this effort by completing and returning the enclosed survey. Recognizing the heavy demands placed on teachers we regret that this task may be an inconvenience for you. However, the Search materials have been very popular for several years among teachers and we need to assess their full impact and use. All of your answers to the questions will be kept strictly confidential.

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Search for Solutions Survey

Years of Teaching Experience:

_____ 1 - 5
_____ 6 - 10
_____ 11 - 15
_____ 16 - 20
_____ over 20

Ages:

_____ 21 - 30
_____ 31 - 40
_____ 41 - 50
_____ 51 - 60
_____ over 60

Academic Backgrounds: Bachelors plus . . .

_____ 0 - 20 Hours
_____ 21 - 40 Hours
_____ 41 - 60 Hours
_____ 61 - 80 Hours
_____ 81 - 100 Hours
_____ over 100 Hours

Sex:

_____ Female
_____ Male

Primary Teaching Responsibility ( ) 50% of your classes):

_____ Life Science
_____ Physical Science
_____ Earth Science
_____ Other (Specify: _____)

Do You Teach Courses Other Than Science?

_____ No
_____ Yes

(If YES, please list here: _____ _____)

How Many Years Have You Been Using The Search for Solutions Films?

_____ 0 - 1
_____ 2 - 3
_____ 4 - 5
_____ More Than 5

For Which Classes Have You Used The Search for Solutions Films? (Check all that apply):

_____ Regular Classes
_____ Remedial Classes
_____ Accelerated or Gifted Classes

How Many Times Did You Show The Search Film Series Last Year?

_____ Times

Approximately How Many Students Viewed These Films Last Year In Your School?

_____ Students

How Many Times Have You Shown The Search Films Series This Year? Number of Students?

_____ Times
_____ Students

PART I.

For the first eight (8) statements, you need only to write the letter in the blank in the right margin that corresponds to the answer most accurately describing you.

1. The number of films I used in the Search series: 1._____

   A) 1 to 3 film titles
   B) 4 to 6 film titles
   C) 7 to 9 film titles

2. I used the films to introduce lessons or activities: 2._____

   A) frequently
   B) sometimes
   C) never

3. I used the films to sum up lessons or activities: 3._____

   A) frequently
   B) sometimes
   C) never

4. I used the films to provide general scientific information: 4._____

   A) frequently
   B) sometimes
   C) never

5. I used the teacher guide: 5._____

   A) with all the films
   B) with one or more of the films (but not all)
   C) without any of the films
   D) did not use the teacher guide at all

6. Frequency of film use: 6._____

   A) use each film only once per class
   B) use one or more films more than once per class, but not all the films
   C) use all the films more than once per class

7. I used these films as: 7._____

   A) enrichment -- not a substantive part of the planned lessons or course
   B) an integral, planned part of my lessons

8. Now that it is legal to make copies of these videos, do you have your own copies (or does the school have its own copies)? If yes, how many? _____ copies 8._____

   A) yes
   B) no

PART II.

Please carefully read each of the following statements. As you do so, express the extent of your agreement with each statement by circling one of the letters (in the right margin) which most nearly describes your present use of the Search for Solutions films series. Then write the letter you circled in the blank space at the right margin. Please use the following scale:

A = Strongly Agree
B = Agree
C = Neutral/Undecided
D = Disagree
E = Strongly Disagree

* *

9. These films had a positive affect on my students' attitudes toward science.	A B C D E	9.____
10. After viewing these films, my students wanted to study science more.	A B C D E	10.____
11. I feel the content of these films is valuable for my students.	A B C D E	11.____
12. The material in these films is presented in an interesting way.	A B C D E	12.____
13. After viewing these films, students have a better understanding that the knowledge of science is constantly changing and not absolute.	A B C D E	13.____
14. Students expressed an interest in science after viewing these films.	A B C D E	14.____
15. The films illustrate the joy of discovery in science.	A B C D E	15.____
16. The students liked these films.	A B C D E	16.____
17. These films fostered an interest in science as a career (in my students).	A B C D E	17.____

PART III.

There were several goals and purposes that fostered the development of the Search for Solutions film series. Listed below are these goals and purposes with response categories for your opinions regarding the degree to which these goals and purposes were accomplished. Please place the appropriate response for each item in the blank to the right.

* *

18. To increase student interest in science:

Increased a great deal 5 4 3 2 1 Did not increase at all

18.____

19. To encourage students to ask questions:

Encouraged many questions 5 4 3 2 1 Encouraged few questions

19.____

20. To present science as study of processes:

Clearly presented 5 4 3 2 1 Not clearly presented

20.____

21. To develop problem solving skills in students:

Developed very well 5 4 3 2 1 Developed poorly

21.____

22. To show both success and failure as part of science:

Shows very well 5 4 3 2 1 Shows poorly

22.____

23. To develop persistence as a characteristic of scientists:

Developed very well 5 4 3 2 1 Developed poorly

23.____

PART IV.

Please answer each of the following questions. Please print, type, or write clearly. If you need more space than is provided, you may continue on the back of this page or include additional sheets.

* * * * * * * * * * * * * * * * * * *

24. Why did you begin using the Search for Solutions films?

25. How did you originally find out about the Search for Solutions films?

26. What do you see to be Search for Solutions' major value for your students?

27. How might the Search for Solutions films be improved if you were able to revise them?

28. Please make any further comments you would like concerning the Search for Solutions film series.

Part V.

Please rate each of the Search for Solutions films in the following grid using t criteria given in each column's heading. In Columns #2 and #3, please note the "5 4 3 1" line. Fo your responses in these columns, please write the number most close representing your opinion. Please use the following scale for the "5 4 3 2 1" line both columns #2 and #3:

5 = Very Good 4 = Good 3 = Undecided 2 = Poor 1 = Very Poor

* * * * * * * * * * * * * * * * * * *

RATING OF EACH FILM

Film Title	Number of times used (approximate)	Quality of production 5 4 3 2 1	Appropriateness for my students 5 4 3 2 1
Prediction			
Modeling			
Theory			
Evidence			
Patterns			
Investigation.			
Adaptation			
Trial & Error			
Context			