

Title: "Winds of Change", the NSCAT CD ROM

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BACKGROUND

NASA now requires every project have a public and educational outreach component. The educational side of this outreach must be based on the needs and requirements of the educational community. The NASA Scatterometer project, NSCAT, is one of the projects that has led the way in this approach to outreach. This was a major departure from what had been done before at JPL. NSCAT was the first JPL project to develop what they have called a "high density" educational product. The "density" of Winds of Change will become self evident in the reading of this paper. The NSCAT project came to the JPL Educational Affairs Office (EAO) to form a partnership in the development of this CD-ROM and associated plans.

APPROACH

The Core Team

Initially the EAO formed what was called a "Core Team". This team was composed of active classroom teachers representing all the grade levels, university educational evaluators and teacher trainers, curriculum specialists and writers, media developers, educational consultants, representatives from the California State Dept. Of Education and NSCAT engineers and scientists. It took several meetings for this varied group to develop a common language, but once this was done (educators learned science and engineering terms and the scientists and engineers learned educational terminology), the design for the NSCAT educational product evolved.

Basic Design

The Core Team, based on focus groups inputs at teacher meeting and many private interviews, decided on the following design criteria:

- Aim the product at middle school, with the subject matter of Global Climate, to have the widest audience.
- Write a teacher resource, but in a way that students could also use directly.
- Use the "web" suggested by our educational consultant, Mr. Bruce Payne [1], to make sure the product was thematic and interdisciplinary.
- Make sure the materials aligned with educational guidelines [2] [3] [4].
- Use a CD ROM as a high density media, but with a very

simple "point and click" interface.

- The final product must be machine independent.
- Develop a systems approach with an evaluation, distribution and follow-on strategy.

EDUCATIONAL DESIGN

Winds of Change Overall Structure

The structure of Winds of Change is illustrated in Fig. 1.

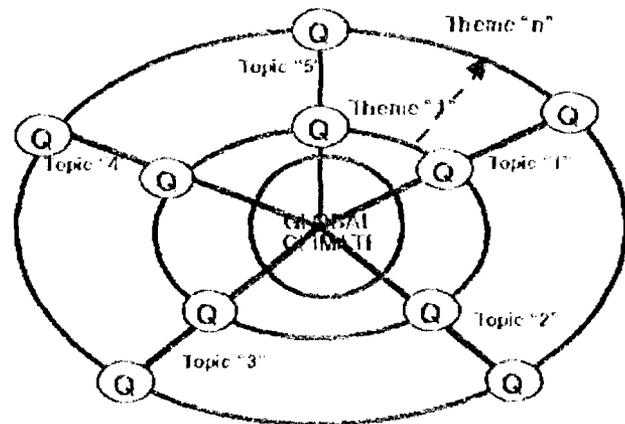


Fig.1 Winds of Change Basic Structure

The concentric ellipses are major themes that come from the educational references, slightly modified from focus group inputs. In the case of Winds of Change, eight major themes were used, (1) Scale and Structure, (2) Measurement, (3) Energy, (4) Systems and Interactions, (5) Patterns of Change, (6) Evolution, (7) Stability and (8) Human Interaction.

The radiating spokes are interdisciplinary subjects. Five were chosen for Winds of Change, (1) Atmosphere, (2) Weather, (3) Climate, (4) Living Things and (5) Oceanography. Wherever a topic and theme intersect, a major question is asked that will be the direction of a whole battery of resource materials. In the case of the intersection of Weather and Structure, the question asked was, "What is Weathers".

Navigating Winds of Change

The navigation system of Winds of Change is either menu or graphical, point and click. When Winds of Change is booted up (on either a Macintosh or IBM compatible machine) the user has three basic menu choices, to find out about how, why and who developed Winds of Change, to get

more background materials on the NSCAT project or to use the curriculum resource. If the curriculum resource is chosen, Fig. 1, with all the eight themes and five topics appears on the screen.

The user then points and clicks on the topic desired. The screen zooms in to this one spoke, allowing much more detailed examination. As the cursor is moved to the intersection of the chosen topic and theme, the major question appears. To zero in on a question, the user clicks on it.

A resource panel then appears on the screen, allowing the user to pick from four types of information, (1) background materials, (2) classroom activities, (3) still images or (4) quicktime movies. All the resources may be electronically copied to an other media (disk, hard drive, etc.) or sent to a printer (color or black-and-white). The background and activities are in the form of PDF files. The images can also be expanded on the screen to be used for classroom presentations on a large monitor.

In this way, the teacher can build up the materials needed to teach a unit based on the specific question in one of many ways. Students can use the materials directly as part of independent study research projects. When this the method of use of Winds of Change, it is suggested that students use a journal, printed or electronic, to record and present their work.

The number of pages of background materials, activities, still photos and quicktime movies varies from question to question. Usually, there are from 7-12 pages of background materials, 3-6 classroom activities, 5-21 still images and from 0-9 movies. In the case of the example stated, "What is Weather?", there are 7 pages of background, 5 activities, 21 still images and 9 movies.

For the three topics of weather, atmosphere and oceanography, there are a total of 194 pages of background materials, 106 activities, 247 still images and 80 quicktime movies.

FIELD RESULTS AND FORMAL EVALUATION

Field Results

The CD-ROM was released in two stages or versions: "Version I" had three "spokes" implemented, atmosphere, weather and oceanography. Approximately 5000 Winds of Change, Version I have been distributed over the last year. Version II is complete with all five topics and is at the time of writing being distributed.

The main complaints from the users of the first version were to do with installation of Adobe Acrobat for the reading of the PDF files. These problems have been fixed with Version II. Users (educators, teachers and students) in response to the subject materials and content for both versions have been very positive.

Formal Evaluation

Version I was sent to the Mid-Continent Regional Educational Laboratory (MERLE) in Aurora, CO, U.S.A. for formal evaluation. MERLE did this evaluation on two levels: an evaluation by professional curriculum developers and a parallel evaluation by a group of inceptor teachers. In addition, MERLE did an alignment of a compendium of the various national standards with the materials on the first version of Winds of Change (only the topics of atmosphere, weather and oceanography). There were a large number of areas they examined, e.g. introductory materials, background information, classroom activities, images, movies, self-directed activities, most appropriate uses, etc.

The teachers gave the materials, based on all the various parameters, a mean rating of 5.4 out of a perfect score of 7. The teachers commented that they especially liked the information, the organization, the activities and the supporting visuals.

The Professional writers gave the first version of Winds of Change an average total rating of 4.5, but noted that the quality of materials in Winds of Change compares favorably with the quality of other middle school science curricula. The professionals liked the combination of text, visuals and activities, the organization and the consistency of format. It was also noted that Winds of Change would have application to high school science, especially 9th grade Earth Science.

The professional evaluators expressed some concern that the teacher level vocabulary might be above the student users. However, the NSCAT project worked with many teachers who reported (about 50% of teachers) they had their students use the Winds of Change for self study. No teacher ever reported that their students had problems with the reading level.

The alignment of the first version of the CD-ROM with the national standards was also revealing. The information is summarized in Fig. 2.

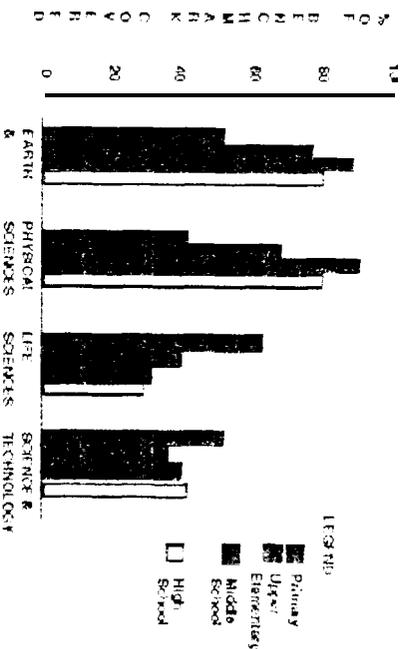


Fig. 2 Standards Alignment

What was found surprising was the large amount of standards that Winds of Change covered beyond the targeted grade levels and subjects areas. At the present time McRRL is doing the alignment for the last two “spokes”, Climate and Living Things. The standards alignment will be even more impressive at that time.

DISTRIBUTION PLAN

The decision was made early in the development of Winds of Change that the CD-ROM that the distribution be done in a “targeted” manner. That is, be distributed, free of charge, at national or regional educator meetings with a large attendance of teachers representing the designed grade levels and subjects. Direct requests from teachers were also honored.

Teachers who are given Winds of Change are requested to fill in a “No Cost Onda Form” or register as an official user. This information will be used later for a long term evaluation of the product. NSC/AT now has thousands of teachers in this data base.

FINANCINGMENTS OF WINDS OF CHANGE

The Educators Information and Exchange Home Page

As part of the CD-ROM section of the overall NSC/AT Home Page [51] is the Educators Information and Exchange area. Educators who use this page can order Winds of Change electronically. The Standards Alignment is also presented on this page. Educators can “click” to one of the main 18 McRRL science standards. Once a major standard is chosen, the user clicks to a set of sub standards, based on details of subject and grade level (K-2, 3-5, 6-8 and 9-12). When a particular substandard is chosen, this page will reference all the background materials, activities, images and movies that can be used to teach this standard. In this way a teacher can decide a path of use of Winds of Change. In future this page will also allow teachers to exchange ideas and methods of use of Winds of Change via a password protected user forum.

FOLLOW ON ACTIVITIES

New Internet Student Activities

Over the next year, several major activities will be instituted as part of the NSC/AT Home Page that will make use of NSC/AT data. Examples of these activities are “Sail the Sea”. Using the wind data and “Value added science products” of NSC/AT coupled with ocean current data from the TOPEX/Poseidon mission, students will plan a sailing voyage from Australia to North America. Part of this activity will be for the students to investigate what stops will be made on this trip and develop information about these ports and countries.

“Wind and Weather” will be an investigation of correlating the NSC/AT wind data with weather maps and observed

circulation patterns. Students will gain an understanding of the ways the world’s winds influence global weather.

A World Wide Student Research Project on Possible Precursor Effects of El Niño

Working with research scientists, modified tables of NSC/AT data for “sensitive” NSC/AT cells (50 kilometer squares of the ocean surface) of the tropical south Pacific will be presented on the home page. Schools, from anywhere in the world, that wish to participate with this project, will form long term research teams that will “adapt” specific NSC/AT cells. These student research teams will carry out long term investigations of the time resolved wind direction, wind speed and ocean currents for these areas. The initial aim of this research will be to establish the range and observed behavior of these parameters during normal weather patterns. When a group of student research teams find data that falls outside of this norm, they will work with each other and the NSC/AT project to see if these observations are indicative of a precursor effect of a coming El Niño.

[1] Private Communications

[2] Project 2061, American Association for the Advancement of Science (1993), *Benchmarks for Science*

Literacy.

[3] National Research Council (1996), *National Science*

Standards.

[4] California Department of Education (1990), *Science*

Framework for California Public Schools: Kindergarten

Through Grade 12.

[5] <http://winds.jpl.nasa.gov>