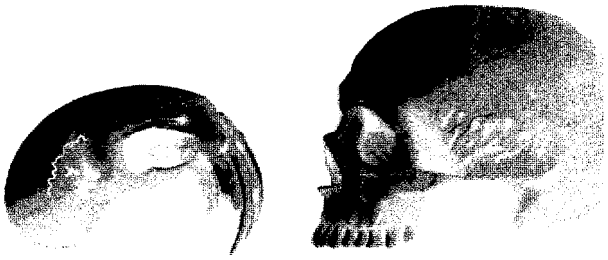
CONTACT



CULTURES OF THE IMAGINATION (COTI) ©

CURRICULUM

A PROPOSAL FOR AN INTERDISCIPLINARY SIMULATION

DESIGNED FOR INTERMEDIATE SCHOOL LEVELS

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CULTURES OF THE IMAGINATION (COTI)
INTERMEDIATE SCHOOL CURRICULUM

INTRODUCTION

The present proposal seeks support for the development of curriculum at the intermediate school level (7th and 8th grades). This focused objective is referred to as the *Cultures of the Imagination* or *COTI* Curriculum project. An outline of the *COTI* Curriculum has been developed previously and tested in two intermediate schools in Area Two of Fairfax County Public Schools, Virginia, and in one middle school in Montgomery County, Maryland.

Funding is being requested specifically for the development and preparation of a teachers' guide that will provide intermediate school teachers with the necessary background information and lesson plans to implement CONTACT's innovative interdisciplinary curriculum.

Benefits of *COTI*

1. Stimulates independent student research, thereby enhancing their interest in and comprehension of all disciplines.

2. Promotes opportunities for cooperative learning.

3. Provides a mechanism for students to apply and coordinate data from their other classes into one project.

4. Promotes a cross-disciplinary approach to the study of physical, biological and social sciences.

5. Offers a means to interrelate art and science curricula.

6. Enables students to see the interrelationship of psychobiological and social behavior with an environment.

7. Provides a culturally neutral vehicle to teach students to deal with physical and cultural differences.

8. Introduces students to a context in which they can discuss ethical values.

9. Allows participation of all students regardless of ability.

10. Keeps school costs at a minimum because props and costumes can be made from recyclable materials, which in turn encourages conservation and recycling.

11. Introduces students to possible career opportunities.

12. Encourages parental involvement.

The *COTI* Curriculum and National Educational Reform

When President Bush announced his education proposals in April 1991, he stated: "To those who want to see real improvement in American education, I say — there will be no renaissance without revolution." The CONTACT Curriculum implements a revolutionary approach to teaching important concepts and skills in all areas of study, and especially in the sciences and mathematics.

One of President Bush's proposals calls for research and development teams to design innovative new American schools to serve as national models of excellence. The *COTI* Curriculum will be an excellent candidate for use in these schools as well as in the traditional classroom.

President Bush's "New American Schools" would utilize the latest in educational technology. The CONTACT project lends itself to the incorporation and integration of state-of-the-art teaching aids including the use of computer software, satellite videoconferences, and interactive laser videodisc technology. Through a special computer network resource center students could access information and ask questions relevant to the project.

This curriculum will provide a "flightpath to the future." Students will not only be a part of the near future which they would simulate in the development of Cultures of the Imagination — they will also have the responsibility as adults of making crucial decisions concerning exploration and the environment that will affect future generations.

The CONTACT curriculum provides an innovative method to help achieve the "National Goals for Education" which were established in early 1990 by the National Governors' Association and President Bush. In particular, *COTI* addresses the objectives of their third goal: "By the year 2000, American students will leave grades four, eight, and twelve having demonstrated competency in challenging subject matter including english, mathematics, science, history, and geography; and every school in America will ensure that all students learn to use their minds well, so they may be prepared for responsible citizenship, further learning, and productive employment in our modern economy."

The *COTI* Curriculum will also help further educational goals outlined by the American Association for the Advancement of Science's (AAAS) "Project 2061: Education for a Changing Future." This AAAS project is a long-term initiative to transform science, mathematics, and technology education for the 21st century.

The first report of Project 2061 — *Science For All Americans* — outlines the basic concepts of science necessary to know how to be literate in science subjects. The CONTACT Curriculum will be designed to involve not only teachers and students, but also their families as well as business and community members.

This curriculum is structured to work well with the National Science Teachers Association (NSTA) Project on Scope, Sequence, and Coordination of Secondary School Science Education. The NSTA Project recommends revising the distribution of science subjects taught in grades 7 through 12. For example, eighth graders (the prime target of *COTI*) would spend two hours per week studying each of the following subjects: biology, physics, and Earth/space science; and one hour studying chemistry.

The diverse areas of study involved in the CONTACT Curriculum would not only fit well in NSTA's revised framework, but would also enhance students' understanding of the interrelationship between all subjects.

COTI and State Curriculum Standards in Science, Social Studies, and Math

COTI provides "hands-on" and "minds-on" experiences for middle school students, and meets the goals and objectives in many areas of study outlined in state curriculum guidelines, as well as by the National Science Teachers Association.

In science, this curriculum involves students in important areas of research and application of the physical sciences as they design their own solar systems, future spacecraft and space habitats, and plan a future interstellar mission of exploration. In the life sciences, they create alien life forms including their internal organs and physiological systems. As they study and apply their knowledge of Earth and space sciences, and technology, students gain a historical perspective of our own place in time and space.

In developing Cultures of the Imagination, students fulfill many social studies objectives as they learn how the atmosphere and geography of a planet affect intelligent life. They also invent a histories, cultures and governments for their imaginary societies.

This curriculum will also involve students in the following areas of study in mathematics which are addressed in the "Curriculum Standards for Middle School Mathematics" established by the National Council of Teachers of Mathematics: problem solving, reasoning, computation, patterns and functions, algebra, statistics, probability, geometry, and measurement.

CONTACT as an organization

CONTACT is a non-profit, 501(c)(3) organization, founded in 1986 by a group of anthropologists, scientists and science fiction writers for the purpose of promoting science and education. A major purpose of the organization is to develop an imaginative educational curriculum that can be adapted to the elementary, intermediate, high school and college levels.

The theme of using a simulated contact between future humanity and extraterrestrial intelligent beings (ETIs) was selected as an imaginative means of inspiring learning in all disciplines and integrating mathematics and science in an exciting interdisciplinary exercise. The name of the organization, CONTACT, refers to the fictive encounter. Cultures of the Imagination (COTI) is what we call that part of the educative experience which creates cultures for the future humans and the ETIs.

Trial runs using the CONTACT COTI scenario demonstrate its value in stimulating participants to investigate a vast array of scientific material, as well as aiding comprehension of concepts from an interdisciplinary perspective. An important element of the COTI scenario is that it approaches science holistically.

Past experience using CONTACT's COTI scenario include the following:

1. For the past eight years, CONTACT members at annual meetings have created and enacted simulations at the adult level.

2. The COTI simulation has been used for teaching by several anthropologists in college classes.

3. A modified COTI simulation has been conducted with intermediate school students in Fairfax County Area II public schools in northern Virginia (Spring 1990). This pilot program was co-sponsored by the Smithsonian Institution's Office of Interdisciplinary Studies and culminated in a one day conference for regional teachers at the National Air and Space Museum in Washington D.C. (July 1990).

4. CONTACT presented a workshop session and simulation at the Maryland Governor's Academy for mathematics and science teachers (October 1990).

5. The COTI simulation was conducted with intermediate school students at the Earle Wood Middle School in Rockville, Maryland. This trial program was performed by 280 science students as part of their classroom curriculum (Spring 1991). A second program is now in progress at the same school.

THE *COTI* CURRICULUM

Content

The *COTI* Curriculum is divided into an introductory segment, eight program units, and a special "superunit" integrating art exercises into all the program units. The project may be expanded or contracted to fit individually the needs of teachers and their classes. It may be implemented by an interdisciplinary team of teachers, or directed by one teacher who may or may not involve teachers in other disciplines. Units or segments of units may be eliminated or emphasized according to the level of the participating students. Options and recommendations will be provided in the teacher's guide.

Scientific disciplines represented in the curriculum include: astronomy, physics, space science, Earth science, environmental science, biology, nutrition, and the behavioral and social sciences. Calculations of time, distance, speed, and mass are integral parts of the *COTI* Curriculum, but the degree of emphasis on mathematics may be decided by the teacher(s). *COTI* may be limited to scientific courses, but it may also be expanded to include other subjects such as art, costume design, drama, music, industrial design, and technology. Involving the members of art and shop classes would increase participation in the simulation, and expose those students to scientific thought.

COTI has worked as an extra-curricular project for interested students and has been incorporated by the teachers into the basic curriculum.

Procedure

The initial selection of the units to be used is made by the teacher or teachers. Major objectives of *COTI* are to encourage independent research, cooperative learning, and critical thinking. The teachers' guide will suggest approaches which work toward those goals.

From pilot projects it is clear that student enthusiasm for the *COTI* project is very great, therefore the need for stimulating interest is not an issue. Teacher guidance is necessary, however, to occasionally remind eager students that they are expected to make decisions based on science rather than pure speculation. To aid teachers, the curriculum will provide lesson objectives and will include background information of pertinent scientific findings in each unit by specialists in the appropriate fields. Each lesson plan will include procedure, materials needed, and methods for evaluation. Additionally, the guide will provide a comprehensive list of resource materials and sources where they may be obtained.

TEACHER GUIDE

INTRODUCTION TO CURRICULUM UNITS

COTI begins with an introduction that is designed to present an exciting vision of humanity's future as a technological, spacefaring culture. Against this background, the students will be given an example of an imaginative encounter between future humanity and an extraterrestrial life-form.

Students are shown the accelerating pace of human achievement as highlighted by the progression of flight from the beginning of the twentieth century to spaceflight today. A plausible scenario for human expansion into space will be presented, including how space helps us improve communication and navigation, observe man's impact on the Earth, and develop tools for better planetary management. The potential of space settlement will be discussed as a future in which mankind overcomes the limits to growth by accessing a wealth of energy from the Sun and the material resources found on asteroids, comets, and other planets.

The students are then invited to consider the impact on humanity of a probe, sent to another solar system, that reports back the presence of alien life. This element prepares them for a better understanding of life in a multi-cultural society. They are asked to consider the differences that an extraterrestrial life-form might present to them. These questions would be typical of inquiries a student might make about someone in the school, or in their neighborhood, who might be new or different.

Finally, the students participate in a simulation involving the hypothetical meeting between a spacefaring human culture of the future and an extra-terrestrial intelligence, both of which they will have created. The students are asked to select which team they would prefer to work on. If necessary, the teacher must use assignments in order to achieve a proper balance of participation on the two teams. Specifically, there should be a balanced mix of students whose strengths are in the sciences and the humanities.

The two teams will lay out together the background of their exercise. They subsequently work in isolation through two parallel sequences of program units. These units lead to a simulation of the final contact between their cultures of the imagination. While working in isolation, mechanisms such as probes might be created to glean further information about each other prior to the contact. After establishing if the project will take place during or after school, the teachers should set deadlines for milestones in each unit.

STAR SEARCH UNIT A
Choosing a star and creating a planetary system All Students

Goals

1. To examine distances in the universe using the powers of ten.
2. To learn about the size and composition of galaxies in the universe.
3. To understand what a star is and be able to identify the main sequence stars.
4. To be able to speculate which type of stars are likely to have planetary systems.

Description

Based on all of the foregoing considerations, both *COTI* team teams are expected to select a star from the existing astronomical catalogue. They must learn which types of stars are most likely to support life and why. They will give that star a planetary system and identify one planet that is suitable for life forms. Students will determine the distance of this planet from Earth in order to determine the travel time to reach it. Travel time may last generations, thus the students must decide how that will be handled.

Unit A is designed to teach astronomy and space science. This subject is frequently taught at a later grade level than intermediate school. If the teachers decide this unit is outside of the curricular focus, it is possible to simply explain the concepts and select a star, establish planets as part of the star's solar system, and develop a planetary atmosphere for the residence of the extraterrestrial intelligence. It is recommended that some student involvement be used in the selection process, however, because it is especially interesting to young students. Even a brief encounter with the selection process in this unit "sets the tone" for contact with the extraterrestrial intelligence.

SPACEKIND — UNIT B1
Creating a spacefaring human culture — Human Team

Goals

1. To understand and develop a socio-economic model of a future society that could support the construction of an interstellar spaceship.
2. To study the major components of human culture and how they integrate in a future society in space.
3. To consider professional and technical skills needed by members of society for life in space.
4. To examine social and behavioral life in the confinement of space settlements and in preparation for a long duration (multi-generational) space voyage.

Description

Students participating on the human team will create a background against which the simulated mission to visit another solar system takes place. The students will study the social and economic factors that go into the creation of a spacefaring civilization.

They will learn about the potential resources in our Solar System for creating oxygen, propellant, energy, and building materials — all essential for the expansion of the human race on the space frontier. Through comparative planetology — Earth and our Solar System companions — this study will provide numerous opportunities to apply knowledge of chemistry.

The human team will also create the Earth-orbiting facilities, Lunar and Mars bases, and asteroid mining facilities for the construction of large structures in space. Studies involving physics, industrial design, and technology are all a part of this unit. Students will be able to explain how people live in these artificial biospheres and design systems of government that manage these diverse cultures. They will be applying knowledge of biology and ecosystems, as well as sociology, psychology, and anthropology.

Students can also create additional scenarios, that involve outposts or orbiting space stations on even more distant planets, to provide in-depth background and understanding of the potential for human activity in our own Solar System.

HAVE SPACESHIP, WILL TRAVEL — UNIT B2
Designing a spacecraft and planning the mission — Human Team

Goals

1. To learn about rocket propulsion systems and theories of future propulsion technology.
2. To use mathematical skills for calculating navigational aspects of space travel and for constructing a spaceship.

3. To learn about the logistics of space travel such as the production of air, water and food, waste recycling, and emergency procedures.
4. To increase environmental awareness by comparing the Earth's biosphere with the closed environment of a spaceship.

Description

This unit is designed to illustrate mechanical and navigational aspects of space travel. The unit will also have the students examine the design requirements of building a structure that can sustain human life in space. This unit introduces the biochemical, behavioral and social needs of human beings. The creation of a closed society may also be used to highlight aspects of human social behavior that students may not have previously considered.

This part of the CONTACT Curriculum is an excellent hands-on activity, especially in applying mathematical skills. In designing a spacecraft and propulsion system, as well as studying the navigational aspects of an interstellar space voyage, students are involved in the following areas of mathematics: problem solving, computations, measurement, algebra, and geometry. Students are encouraged to make blueprints or construct a model of the spacecraft, furthering the use of these math skills.

EXPEDITION TO THE STARS — UNIT B3
Training for contact — Human Team

Goals

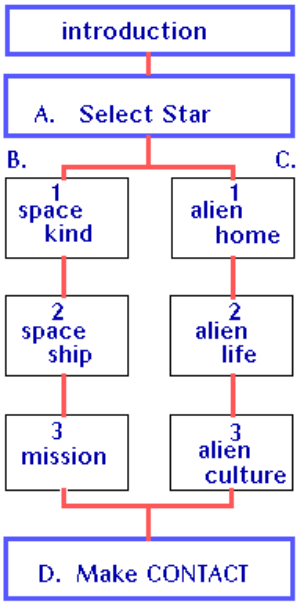
1. To provide the opportunity for students to explore professional careers in our technological society.
2. To teach the principles of expedition management.
3. To examine anthropological concepts that derive from intercultural contacts, such as: ethnocentrism, anthropocentrism, terra-centrism, universal symbols and greeting gestures, taboos, and culture shock.
4. To consider cross-cultural and inter-species contact.

Description

Working in isolation, the human team should consider the kinds of exploration and experimentation that will be done when the human crew reaches the new planet. Students can explore professions that deal with information management, cultural relations, psychological training and activities related to maintaining the mission profile and assuring a successful contact with an alien culture. This exercise provides an opportunity to invite community members in related careers to give presentations and work with students, as well as answer some of their questions.

Of major importance in this unit is the introduction of ethical concepts and a discussion of how humans should approach meeting new cultures and races. It is designed to examine the students'

own culture. This unit can be tied to life aboard the spaceship in Unit B2 whether or not that unit has been emphasized.



COTI jr Flow Chart

ALIEN HOME WORLD UNIT C1
Creating an atmosphere and planetary features Alien Team

Goals

1. To examine the importance of atmosphere for life forms.
2. To determine how gases relate to the kind of organisms that will appear and evolve.
3. To explore the relationship between the geology, geography, and chemistry of a planet.
4. To understand natural planetary cycles.
5. To emphasize the importance of Earth science to biological organisms.
6. To reinforce knowledge of solar and planetary systems.
7. To create accurate planetary models.

Description

This unit builds upon the work done in Unit A, taking into account the luminosity and mass of the star and the planet's distance from it. Students from the alien team will create an atmosphere suitable for life. They will establish the climatic patterns and geological structure of their planet. Land masses, mountains, water sources, types of vegetation, and weather patterns are some of the features that need to be considered. Students can create a globe showing the physical geography of their planet. This will give them a visual sense of their simulated world.

Unit C1 is designed to show the relationship of environment to living organisms. The subject matter in this unit is generally covered in 7th and 8th grades, so the entire unit is recommended for use in *COTI*.

EVOLVING INTELLIGENT BEINGS UNIT C2
Biological environments and corresponding physiologies Alien Team

Goals

1. To examine the anatomical and physiological make-up of organisms.
2. To study the interrelationship between the environment and the flora and fauna.
3. To learn about the development of tools and technology.

Description

Alien team students are expected to create extraterrestrial organisms with biological structures that are compatible with the created planetary environment. As a method of maximizing knowledge about biology, behavior, and socio-cultural patterns, it is recommended that students create organisms as different as possible from human beings. By drastically changing the form and

physiology of their intelligent alien, the students must think more deeply about the interrelationship of these characteristics with behavior, communication and culture.

Having created the alien's internal biology and physical characteristics, the students must establish the technical skill level, if any, achieved by their creation. Unit C2 is designed to examine the biology, behavior, and socio-cultural characteristics of organisms. These topics are treated in 7th and 8th grade, therefore it is recommended that this unit be emphasized. We suggest that two extraterrestrial beings be created so that the students learn about the social and evolutionary interrelationship of organisms in an environment. At least one, if not both extraterrestrials, should have an intelligence equivalent to humans. The unit involving contact is dependent upon a response between foreign intelligences.

COOKING A CULTURE UNIT C3
Creating cultural attributes and communication systems Alien Team

Goals

1. To study how a culture might develop in the context of an intelligent alien's biology and ecology.
2. To relate socio-cultural behavior to the biological make-up of organisms.
3. To explore systems of communication.

Description

The students are expected to establish behavior, culture and language appropriate to the creature and its environment for their organisms. Based on the technology developed in Unit C2, the students must show how the aliens use that technology and how that technology affects their culture. The students must also devise systems of government and explain interaction between alien individuals (if they recognize that concept) and their governmental system. They may also establish and examine relationships between individuals and examine the possibility of cultural units that exist at intermediate stages between a large government structure and smaller, "family," units, if they exist.

CONTACT UNIT D
Establishing communication between cultures All Students

Goals

1. To simulate an encounter between human and extraterrestrial intelligence (ETI).
2. To increase analytic abilities by having students analyze simulations.
3. To use simulated contact as a stimulus for discussion about cultural or physical differences.
4. To evaluate what has been learned by student self-assessment.

Description

Students assuming the role of the human crew should land upon the created alien world and make contact with one ETI group. Following the simulation, both participating and observing students can analyze the "contact" situation. If a second ETI has been created, the process can be repeated. A third simulation involving both groups of ETIs and Earthlings can occur. Sequential simulations should be designed to address specific issues, thereby increasing the learning potential. The final analysis should include an assessment by the students about what they learned.

The teachers may use this unit as a means of engaging students in a discussion about "difference." ETIs are neutral, in that Earthlings have never been in contact with them. However, social differences do exist in our human societies based on culture, ethnicity, race, and physical or mental disability. *COTI* provides a vehicle for students to compare simulated encounters with experiences in their own lives.