School Science Program Description
C^3P--Comprehensive Conceptual Curriculum for Physics

Origin/Scope

- Principal Investigators:
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  Project Dates:
  1993 - present
  Number of Active Sites:
  approximately 550
  States:
  All 50 states
- Research base:
  The curriculum and resource materials implement learning cycles based upon Piaget's work. Specific pedagogical strategies, such as identification and changing of students' alternate conceptions and Socratic dialogue techniques, are based upon the works of researchers in physics education including Lillian McDermott, Richard Hake, John Clement, Ron Thornton, and others.

General Description

***Program Overview*:**

- Grades served?
  - ✓ The curriculum is designed for 9^{th} or 10^{th} grade physics courses but has elements applicable to all high school grades.

- Does the program offer a comprehensive rather than supplemental curriculum?
  - ✓ The Program offers a comprehensive curriculum and resource materials.

- What are the program goals and principles?
  - ✓ To produce and disseminate a comprehensive conceptually based physics curriculum for all high schools, usable by all teachers, and effective for all students.

- How does the program relate to the National Science Education Standards and/or Project 2061 Benchmarks?
  - ✓ The Program was developed in step with the National Science Education Standards, Project 2061, NSTA, and NCTM standards projects. Correlation of these standards and learner outcomes are provided.

- What expectations does the program set for **all** students?
  - ✓ The Program designates specific learner outcomes, hands-on activities, and assessment activities that **all** students should achieve.

***Program Content and Strategies*:**

- How is the course content organized?
  - ✓ The course content is organized by specific learner outcomes as in the following example:

Topic 5

Subtopic 5.2

Element 5.2.1

Learner Outcome 5.2.1.3

- E : Essential
- E1: Expected
- E2: Extended

Specific activities to support the learner outcomes are hyperlinked to the outcomes. Learning cycle strategies are embedded in the organization of the course.

- What science concepts and ideas are represented and how are they connected to each other and to students' lives?
  - ✓ The program covers the following topics in physics:
    - Habits of the Mind
    - Matter, Space, Time
    - Kinematics and Motion
    - Forces and Newton's Laws
    - Energy, Momentum, and Conservation
    - Electricity and Magnetism
    - Waves
    - 20th Century Physics (sprinkled throughout the curriculum)

- How does the program promote students acquiring a deep understanding of important science concepts and ideas?
  - ✓ The Program reduces the amount of time teachers spend lecturing and replaces classroom learning with hands-on activities, dialogues, and discussions. The teachers facilitate students' own construction of scientific ideas.

- How does the program balance and integrate concepts, skills and processes, including learning through hands-on experiences and inquiry?
    - ✓ The Program has an integrated learning cycle approach to teaching that includes the following:

EXPLORATION

Students learn through own questions and actions.

Students use materials to acquire information.

Activities raise additional questions for students.

Students work cooperatively.

CONCEPT DEVELOPMENT

Teacher-led discussions help answer students' questions.

Student understanding is promoted through focus.

Concept language is developed.

APPLICATION

Students have time and experience with new concepts.

Students accommodate new concepts into existing concepts.

Students transfer learning to new situations.

- In what ways does the program engage students in scientific inquiry? What portion of assignments are student-led or open-ended?
    - ✓ As indicated above the Program constantly engages students in scientific inquiry. Approximately two-thirds of all activities are student-led.

- What opportunities does the program make available for students to explore phenomena in the classroom, school yard or community?
    - ✓ Many activities take the students into the halls, gym, and outside for data gathering. Student projects take students into the community.

- How does the program help teachers facilitate student-centered learning for all students? (e.g., use of multiple effective strategies; providing for diverse interests, skills, and learning styles; building on prior knowledge and conceptions; presenting accessible tasks)
    - ✓ The Program has specific activities that facilitate student-centered learning. The TOLT test is administered to students as well as a learning styles test. The entire emphasis of the Program is on student-centered learning. See the interactive CD-ROM.

- How does the program help teachers develop knowledge of effective science teaching and learning?
    - ✓ The Program facilitates teachers using learning cycles and thus helps them improve their teaching of science.

- What kinds of extended learning opportunities for students does the program offer?
    - ✓ The Program provides activities that go beyond the classroom.

- How does the program help make science accessible to all students?
    - ✓ The Program provides activities linked to specific learner outcomes that are hands-on . The majority of activities require low-tech equipment.

- How is technology incorporated into instruction and student learning?
    - ✓ Calculator-Based Labs (CBL) technology is integrated into activities.
    - ✓ The materials are developed via CD-ROM.
    - ✓ Simulation software is included on the CD-ROM for some lessons.

***Assessment*:**

- What assessment practices are used and how do they align with instructional practices?
    - ✓ The Program provides a variety of assessment tools that include portfolios, teacher observables, multiple choice, and open-ended essays.
- In what ways do assessments inform student learning and guide teachers' instructional decisions?
    - ✓ The learning cycle approach provides teachers with continual assessment of students' understanding. Program has applied for funds from the National Science Foundation to develop a more extensive resource of assessment tools.
- Does the program supply or recommend annual pre- and post-assessments that are aligned with the curriculum to measure student achievement?
    - ✓ Yes, the Program provides pre- and post-assessment tests that are aligned with the curriculum. The tests can be found under the RESOURCES on the CD-ROM.

Professional Development

- What training prior to or early in the process of implementation (such as workshops or summer institutes) is provided? Please provide documentation, such as a sample agenda used for training.
    - ✓ The Program provides workshops for implementation. The workshops are offered by Program Mentor Teachers during the school year and also during summers and consist of 45 - 60 hours. A sample agenda is attached. The materials are sold **only** through workshop participation.

- What provisions are there for on-going, on-site coaching and support during the first two or three years of implementation (follow-up visits, use of local facilitators, development of practitioners as teacher leaders, mentoring, peer coaching, etc.)? Please provide documentation, such as a brochure or school implementation plan.
    - ✓ The Mentor Teachers provide on-going support to teachers who have participated in their workshops. The support is offered through visits, telephone conferences, and email. In addition, the Program has a listserver through which anyone may address questions.

- How does the program help schools and districts develop internal capacity for long-term professional development in using the program?
    - ✓ The Program provides correlation of the curriculum with national standards.

- Is follow-up professional development a recommended or a required feature of implementing the program?
    - ✓ Follow-up professional development is recommended but not required.

- What networking opportunities do participating teachers have to observe, learn from, and support one another (annual conferences, scheduled visits to other schools, newsletters, e-mail lists, Web sites, etc.)?
    - ✓ Networking opportunities include a newsletter, email, a listerver, and a web site (http://phys.udallas.edu).

Family Involvement

- What family involvement components does the program include? (e.g., outreach/awareness, students interacting with family members as part of homework, letters home to parents)
    - ✓ Some activities require students to perform simple experiments at home.

Results (Note: Please provide **a copy of all documents** cited)

- **Overall summary of results**, particularly impact on student academic achievement (measurable significant gains in student understanding of science concepts and ideas, inquiry and scientific thinking skills, performance assessment scores, evidence of narrowing the gap in achievement among disaggregated groups, standardized test scores, grades, and other measures of achievement in science); number of sites involved; type of schools involved (urban, rural, Title I, etc.); period of time over which effects have been demonstrated; and assessments used. Please note methodology for each evaluation cited— *Treatment/Matched Control Group Evaluations*, *Comparison Group Evaluations* (other schools, district means, etc.); or *Other Data* (non-comparative evaluations, pre- and post-assessments, case studies,

surveys, etc.). Please list references for each evaluation, noting if study conducted by developer/implementer or independent evaluator; be sure to include dates.

- **Impact on non-academic indicators:** Summary of results on student attendance, retention, course-taking patterns, graduation rate, behavior, student attitude/confidence regarding science, post-secondary decisions, impact on teacher practice, knowledge and attitude, school climate, parent involvement. Please list references for each evaluation, noting if study conducted by developer/implementer or independent evaluator; be sure to include dates.

- **Studies of Implementation:** Summary of studies addressing degree of implementation in schools and districts (progress toward achieving goals; changes in classroom practice, collegiality, and school governance; fidelity to program design; etc.) Please list references for each evaluation, noting if study conducted by developer/implementer or independent evaluator; be sure to include dates.

- **Other Studies** Any other relevant studies; Please list references for each, noting if study conducted by developer/implementer or independent evaluator; be sure to include dates.

    - ✓ Kay Thomas of the Texas Center for Educational Researcher conducted an external summative evaluation of the Program. Her complete report is attached to the hard-copy of this form.

Implementation Assistance

- ***Program Capacity:*** Organizational structure and staffing (national center, regional centers, number and availability of trainers, etc.). At how many schools has the program been implemented for each of the past two years? How many new sites do you estimate you can serve next year? We are looking for evidence that you are capable of supporting implementation at multiple sites.

    - ✓ Approximately 460 teachers in 1998 and 90 in 1999 implemented the Program.

- ***Faculty Buy-In:*** Any requirements for formal or informal commitment on the part of school faculty (e.g., 80% of teachers must approve on secret ballot).

    - ✓ Schools have been required to sign formal letters of commitment.

- ***Implementation Review:*** Efforts to determine how well schools are implementing the program (on-site reviews, instruments for self-assessment, etc.).
    - ✓ No such implementation reviews have been conducted outside of those presented in the external evaluation report.

Costs/Impact

- What does implementation look like? What do schools get? Over what period of time?
    - ✓ Teachers receive training and the option for 3 hours graduate credit in physics through the workshops. The schools receive the CD-ROM. The period of time is the length of the workshop.

- What does implementation cost? Enumerate fees for membership, training, materials, etc. Also describe additional expenses schools incur as a result of implementing your program (new staff positions, release time and travel for teachers, new technology, etc.). Since the latter expenses will vary from school to school, you may want simply to describe them without attaching a direct dollar figure.
    - ✓ The cost of a summer workshop is approximately $600, which includes room and board, instruction, make and take materials, and the CD-ROM.

- What organizational expectations are there for schools implementing this program? (access to science equipment or materials, Internet, etc.; availability of time for teacher planning or professional development; suggested changes to scheduling)
    - ✓ In order to implement the Project, schools must provide physics lab equipment, at least one computer with CD-ROM drive, graphing calculators, and CBL equipment.

Student Populations

- Has your program been implemented in Title I, urban, suburban and rural schools?
    - ✓ Yes, in all these types of schools.

  In schools serving large numbers of disadvantaged students and children with disabilities? Do you have special materials for English-language learners? Has your program been especially effective with any of these student populations?
    - ✓ No.

  Please estimate the number of schools you have served that are high-poverty and the number of schools that serve large numbers of English-language learners. In general, we are seeking evidence that your program has been used successfully with a wide range of students.
    - ✓ Approximately 10% of the schools are high-poverty.

Special Considerations

- Use this section to highlight issues that may be of special interest or concern to schools. For example, will there be teacher contract issues? Might community resistance be a problem? Does the program require full inclusion of students with disabilities?

Sample Sites

- Name, address, phone number, and contact person for five schools willing to be listed as active sites. Please include brief contextual information for each school: location (urban/suburban/rural), student population (% minority students, students with disabilities, English language learners, students receiving free lunch), and other information that will help readers compare sample sites with their own buildings.

Gibson	Al	gibson@oakland.edu	Rochester Adams High School	3200 W. Tienken Rd.	Rochester Hills	MI	48306
Head	Janie	janieslog@aol.com	Lamar Consolidated High School	4606 Mustang Ave.	Rosenberg	TX	77471
Mader	Jan	janmader@aol.com	Great Falls High School	1900 2nd Avenue S.	Great Falls	MT	59405
Matsler	Karen Jo	kmatsler@arlington.k12.tx.us	Lamar High School	1400 Lamar Blvd. W.	Arlington	TX	76012
Ward	Mary	jayward@ix.netcom.com	Landsdale Catholic High School	700 Landsdale Ave.	Landsdale	PA	19446-2995

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