I. Vision and Rationale

With the recognition that there is a natural symbiosis between colleges and secondary and primary schools, Rensselaer Polytechnic Institute established a Center for Initiatives in Pre-College Education (CIPCE). In so doing, it has reinforced the vision of its founder, Stephen Van Rensselaer, to qualify teachers for instructing the sons and daughters of farmers and mechanics, by lectures or otherwise, in the application of experimental chemistry, philosophy and natural history, to agriculture, domestic economy, the arts and manufactures.

Realizing that for too long now the nation’s best research universities have often sat idle while our system of public school education has deteriorated, Rensselaer intends to take the lead in forging new relationships which will become models for others to follow. Educators at all levels, and leaders in government, business and the philanthropic community, are unanimous in their deep concern that students in kindergarten through twelfth grades are not being properly educated and are not ready to enter the technological workplace that awaits them. Therefore Rensselaer believes that it shares with the nation’s schools an obligation to develop and deliver a first-class education to students at all levels. It also believes that the work of this Center in pursuit of that goal can enrich its intellectual environment, tap new sources of external funding, deliver substantial long-term benefits to its admission efforts, and improve its public and community relations.

II. Objectives

To achieve its vision, the new Center seeks to foster innovations in pre-college education that build upon Rensselaer’s strengths and traditions in pedagogy, interactive learning, educational technologies and teacher education. It will do so with the following objectives in mind:

• to provide services to the Rensselaer community through a low overhead, self-supporting center that seeks to leverage and coordinate, but not necessarily control, diverse pre-college outreach initiatives already thriving across the Rensselaer campus;

• to encourage, support, monitor, publicize, raise funds for, and administer current and future initiatives in pre-college education;

• to administer self-supporting professional master’s programs in teacher education and certification; and

• to help appropriate campus offices identify and exploit opportunities for marketing, internal and external publicity, and community and government relations that are based on pre-college outreach or that might generate new support for them.
III. Present CIPCE Supported Initiatives

The following is a list of initiatives that CIPCE presently supports or coordinates, either fully or in partnership with other educational entities. These are described more fully on the attached pages.

1. MS In Natural Sciences for Secondary School Teachers of Mathematics and Science
2. MS in Engineering Principles in Technology Education for Secondary School Technology Education Teachers
3. Long Distance Learning Initiatives
4. College Board Partnership
5. Public Television Partnership
6. New York State’s Systemic Initiative
7. Workshops, Institutes and Short Courses
8. Greater Capital Region Teacher Center Partnership
9. Development of Multimedia Materials
10. SUNY Albany Partnership
11. PhD in Mathematics Education
BRIEF DESCRIPTIONS OF PRESENT CIPCE SUPPORTED INITIATIVES

1. **MS In Natural Sciences for Secondary School Teachers of Mathematics and Science**

The development and initial implementation of this graduate program was funded by Rensselaer’s Strategic Initiatives, and it graduated its first class in the summer of 1997. Mathematics and science teachers spend six weeks at Rensselaer during each of three successive summers, during which time they earn ten credits. This degree program departs from traditional graduate education in the teaching arts in three ways:

- **content**—many of our courses emphasize the nature and processes of mathematics, science, and technology, and their relevance in classroom education;
- **technology**—use of modern instructional technologies is a common theme throughout the program, with each teacher asked to apply these technologies to teaching challenges and to take new course material to her or his classroom;
- **pedagogy**—instructors in the program will model inquiry-based learning to exemplify teachers’ classroom options.

Participants in this program are proving themselves capable of being lead teachers in their respective school districts, of spearheading local education reform efforts, and of mentoring others in the use of instructional technologies in the classroom.

2. **MS in Engineering Principles in Technology Education for Secondary School Technology Education Teachers**

In 1995 Rensselaer received a $280,000 FIPSE grant from the U.S. Department of Education to develop and begin implementation of a program leading to a *Master of Science in Engineering Principles in Technology Education* for secondary school technology education teachers. This program will begin in the summer of 1999 and will span three consecutive summers. It will stress an approach to the teaching of secondary school Technology Education, Tech Prep or Principles of Engineering courses that will have a strong focus on engineering rather than the more traditional focus on product design. It will stress, at an appropriate level,

- engineering design and analysis;
- embedded control, including microprocessor hardware and software interfacing;
- engineering manufacturing which will integrate various skills, technologies and practices; and
- an interdisciplinary approach to the teaching of mathematics, science and technology.

Through this up to date approach to technology education, the students of the teachers in the program will have a much broader, more fundamental and interesting introduction to engineering technologies and to careers associated with these disciplines.

3. **Long Distance Learning Initiatives**

(a) Advanced placement courses for students

CIPCE, together with Rensselaer’s *Center for Innovation in Undergraduate Education*, Rensselaer’s *Center for Entrepreneurship*, and the offices of the Deans of Computing and Information Services and Undergraduate and Continuing Education, has received grants from the AT&T and Bell Atlantic Foundations to develop and deliver college-level, WEB based courses to high school students, especially those in inner city schools. This will ensure maximum career options for these students, and will begin to transfer Rensselaer’s expertise in student-centered learning environments to the pre-college area.
(b) Contemporary science topics for teachers

Together with the Rensselaer’s Physics Department, and in partnership with the Greater Capital Region Teacher Center, CIPCE will help to develop and implement long distance short courses on contemporary topics in physics for teachers of physics. The key idea is to provide materials and background, through long distance technologies, which will prepare educators to teach and answer questions about physics topics that are exciting to students. After a trial period, this will be extended to the other sciences, including mathematics.

4. College Board Partnership

CIPCE has been invited to develop a partnership with the College Board as it seeks to enlarge its offerings to advanced placement teachers through enrichment experiences in mathematics, in the sciences, and in the use of instructional technologies in the classroom. A two day workshop on the use of the World Wide Web as a classroom research tool was offered in the spring of 1998 to secondary school mathematics and science teachers, and a one week institute in the programming language C++ is being planned for the summer of 1999.

5. Public Television Partnership

CIPCE has developed a working partnership with WNET, the nation’s largest public television station based in New York City. It is working with WNET to develop a certificate program in the use of instructional technologies using long distance teaching technologies, and presently offers Rensselaer credit for summer and academic year institutes sponsored by WNET that stress the use of video and other technologies in K-12 classrooms.

6. New York State’s Systemic Initiative

Lester Rubenfeld, CIPCE’s Director, is a Principal Investigator on a National Science Foundation’s $10 million grant to the New York State Department of Education under its Statewide Systemic Initiative (SSI) program. The purpose of this grant is to systematically reform the way mathematics, science and technology is taught in the classrooms of the six largest urban school districts of New York State. Through this involvement, Rensselaer is playing a vital role in policy changes at the New York State Department of Education focusing on standards-based reform in the teaching and learning of mathematics, science and technology, and on the development of appropriate tools to assess these changes. As part of this involvement, Rensselaer has been the home of multi-week summer institutes for elementary and middle school teachers which focus on mathematics, science and technology inquiry.

7. Workshops, Institutes and Short Courses

(a) Microgravity institute

In partnership with Rensselaer’s Department of Materials Engineering, and the Greater Capital Region Teacher Center, a two week institute was offered in the summer of 1997 for secondary school teachers of mathematics, science and technology, which had as its focus an experiment that was conducted by faculty and staff in Rensselaer’s Materials Science Department. This experiment in microgravity took place in outer space during a NASA liftoff in the fall of 1997, and the data collected in real time at Rensselaer. Teachers who participated in the institute were taught about the science and engineering aspects of the experiment, and developed and implemented in their classes curricula centered around this.

(b) Mathematics and science inquiry workshops and institutes

As part of CIPCE’s involvement in New York State's Systemic Initiative, and with additional support from the Eisenhower Title IIA Program, CIPCE has offered, and continues to offer, two
and three week long summer and academic year institutes and workshops in mathematics and science inquiry. These were attended by teachers in grades K-8 from throughout New York State.

(c) Institute in engineering principles for Technology Education teachers

This one-week institute for twenty two secondary school technology education teachers coming from throughout New York State was held during summer of 1998. It was facilitated by faculty and staff from Rensselaer’s Schools of Engineering and Science, and stressed the development of mathematical and engineering models of physical and electrical systems. Participants constructed a model of a MagLev system that they could incorporate into their own classrooms.

(d) Instructional Technology workshops

With Eisenhower Title IIA, Goals 2000 and Technology Literacy Challenge Grant funds, CIPCE is working with elementary school teachers in the Troy and Riverfront Consortium School district on the use of instructional technologies in the classrooms. Through after school workshops, summer institutes and in-class activities, a Technology Professional Development Team hopes to bring these teachers to a point where they are not only comfortable with the use of the “tools of technology,” but can use these tools in a creative, inquiry based manner in their classrooms.

8. Greater Capital Region Teacher Center Partnership

The Greater Capital Region Teacher Center is funded by the New York State Legislature, reaches over 12,000 teachers in the Capital District region, and is responsible for organizing and implementing staff development initiatives for them. The Teacher Center partnered with CIPCE, and Rensselaer’s Department of Materials Engineering, to present a two week microgravity institute in the summer of 1997. It serves as a vehicle for Rensselaer to advertise many of its programs, and helps identify participants for these programs. The Teacher Center also financially supports Renssaler’s course offerings to local teachers.

9. Development of Multimedia Materials

(a) CIPCE recently received a two year grant from Bell Atlantic to develop and implement interactive multimedia, web-based materials for Advanced Placement Calculus. This work is being done with Rensselaer’s Academy for Electronic Media and will be piloted in several local area schools.

(b) CIPCE has recently applied for a grant from the New York State Department of Education under its Instructional Technology Staff Development Initiative. Through this grant, CIPCE will work with Rensselaer’s Academy for Electronic Media to develop interactive multimedia mathematics, science and technology education materials for use in secondary school classrooms. The technology education materials, in particular, will stress circuits and manufacturing concepts, and will be directed towards tech prep and other vocational students who might be planning to enter high technology industries, or proceed to a two year college for a certificate program.

10. SUNY Albany Partnership

Faculty and staff from SUNY Albany’s School of Education are working with CIPCE and other Rensselaer faculty and staff on several initiatives. Among these are:

(a) Several SUNY graduate students are part of CIPCE’s Technology Staff Development Team which is developing and implementing staff development activities for elementary school teachers in the use of instructional technology in their classrooms. Teachers from the Troy and Riverfront Consortium School Districts attend after school workshops and summer institutes.
(b) SUNY faculty and graduate students are working with CIPCE to evaluate several of its staff development projects.

(b) SUNY Faculty and graduate students are working with faculty from Rensselaer and Russell Sage College on the development of a cognitive research agenda which will assess the effect of classroom use of technology on the teaching and learning of mathematics, science and technology.

11. PhD in Mathematics Education

CIPCE is working closely with Rensselaer’s Mathematical Sciences Department on the development of a PhD program in mathematics education. The objectives of this program are to research the effect of changing pedagogy and the use of instructional technology in university and pre-college mathematics and science classrooms.