University Studies Core Curriculum

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Core Curriculum

Final Report

Preston K. Covey
Vice Provost for University Studies
September 10, 1988

FINAL PROGRESS REPORT to THE PEW MEMORIAL TRUST
On Activities Supported by a Grant to Carnegie Mellon University
For Development of a University-Wide Core Curriculum

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Executive Summary

Carnegie Mellon's proposal to the Pew Charitable Trusts in April of 1985 proposed a "renewal of undergraduate education" through the implementation of a university-wide core curriculum. The basic objectives were to develop (a) curricula that nurtured "fundamental -- but critical -- intellectual skills," especially in writing and computing, as well as (b) interdisciplinary curricula that focused on "the relationships among science, technology, and the liberal arts."

Requirements. The components of university core requirements are (1) a university-wide writing requirement, whereby everyone takes either the Strategies of Writing course or (by virtue of Advanced Placement) a designated writing course; (2) university-wide computing requirements, consisting of the Computer Skills Workshop and a computer language course; and (3) distribution requirements in the arts and sciences, which vary with the college: for example, engineering students take eight courses (including writing) from the College of Humanities & Social Sciences and humanities/social science students take a mathematics and two natural science courses from the Mellon College of Science. The foundation of distribution requirements for all our colleges is the core curriculum structure of the College of Humanities & Social Sciences, which consists of five area requirements:

2. Humanistic & Social Values.
4. Language, Culture & the Arts.

General education vs. core requirements. University core requirements are inevitably relative: a computer language or calculus course required of everyone is not the same order of requirement for a computer science major as it is for an English major; ditto for science courses for science majors, writing courses for professional writing majors, history courses for history majors, etc. We describe university-level requirements as "general education" rather than "core" requirements: the goal is commonality of breadth, not commonality per se. General education is professedly relative, encompassing subjects or skills arguably required of any educated person but beyond one's own area(s) of specialization.

In the academic year 1987-88, the university established an official body for the on-going review and revision of general education requirements as well as other university-wide educational issues, the University Education Council (UEC). The UEC is one of two councils that report to the Deans Council, the oversight body for all university affairs chaired by the Provost; the other is the University Research Council (URC). The UEC was set up in recognition of the need for continual attention to educational policies and requirements.

Opportunities vs. requirements. Effective requirements require good offerings and opportunities. New general education initiatives are a responsibility of University Studies,
working collaboratively with the campus community. University Studies was set up in 1987 to address the continuing need for university-level initiative in improving opportunities for general education. Among these continual improvements are (1) new curricula that satisfy general education requirements, (2) curricula that enhance general education beyond what is required of students, (3) innovations in educational technology that enhance the efficacy of general education, and (4) extra-curricular programs. University Studies administers the Pew grant and has brought the following programmatic strategies and priorities to the project of improving the university's general education offerings for (a) "fundamental -- but crucial -- intellectual skills" and (b) "the relationships among science, technology, and the liberal arts."

**Generative mechanisms.** University Studies has established generative mechanisms for general education, in order to ensure impact and continuity beyond the life of any individual project. Since 1986-87, no course or project has been funded unless the responsible program or department could ensure continuing maintenance. The goal has been 'robust' innovation that will take root in the community, that will maintain and generate initiatives independently of University Studies support. For example:

- The **Writing Across the Curriculum (WAC)** project has been integrated with the research agendas of English and Psychology department faculty and has established continuing collaboration between English faculty and faculty in other colleges.

- The university has provided continuing funds to expand the staff of the **Strategies of Writing** course, the cornerstone of the WAC program, as a university-wide requirement.

- The **Professions & Society** course is similarly integrated with the applied and social history research agendas of the History department.

- The several gender studies curricula initiated by University Studies together with an interdisciplinary faculty committee on gender studies created enough focus and critical mass to inaugurate a **Gender Studies Minor Program**.

- The **Computer Skills Workshop (CSW)** is now established with its own budget.

- The university has built a $300,000 teaching and lab facility for CSW and other computer-intensive courses generated by the **Computer Languages, Applications & Systems Program (CLASP)**, which invites courses from across the university.

- University Studies' interdisciplinary focus on ethics and values across the university has generated the new **Center for the Advancement of Applied Ethics (CÅAE)**, established in June, 1988.

- This interdisciplinary focus on values in the arts, sciences, and society has also been incorporated into the new **University Scholars Seminar Program** (an upper-level, interdisciplinary, general education seminar program to bring together students and faculty from all colleges, to be piloted this academic year).

- University Studies provides academic venue for initiatives like the **Student Pugwash Symposia on Values, Science & Society**, mini courses like "Fencing in High Tech," on geo-political issues of technology transfer, and the university-wide Symposium on the Role of Design in Liberal / Professional Education (the volume of papers is submitted herewith).
• University Studies sponsored a study of January Terms at other institutions and together with the university's Quality of Life Task Force generated a proposal for a January Term at Carnegie Mellon dedicated to small general education seminars or projects, which has been taken up by the University Education Council this year.

• The University Studies emphasis on general education beyond core requirements has inspired a fund-raising project for a University Studies Undergraduate Research Fellows program to support research projects outside students' areas of specialization.

Strategic innovation and integration of educational technology in general education. Coincident with Carnegie Mellon's commitment to renewal in general education was a very ambitious campus computing project. Conceived and funded jointly with IBM, the goal of the Andrew project (named after the university's two Andrews, Carnegie and Mellon) was to build both high-level system software and an advanced distributed file system and campus-wide network that would support advanced applications for education as well as a wide variety of computers. Research applications of computing at a research- and technology-intensive university like Carnegie Mellon are myriad; it was the goal of the Andrew project to facilitate equally sophisticated and powerful uses of computing in education.

It has been a goal of University Studies to exploit the comparative advantage of the university's computing environment for general education. General education, by definition, suffers from one serious endemic liability: relatively limited exposure of students to subjects, skills and problem domains that are both important but unfamiliar. General education has special need for the power of computer technology to facilitate and enhance learning for which there is limited time or exposure.

Therefore, University Studies, in collaboration with the Center for Design of Educational Computing, has undertaken to identify and support innovations in technology that promised strategic and seminal impact for general education in the priority areas below. Technological applications also provide animated models and exportable vehicles for educational innovation.

Seminal impact means that an application will seed and propagate impact in more than one educational setting or domain, will serve as a model for propagating new educational strategies or as a paradigm for the design and implementation of like applications.

Strategic impact means that an application will not simply facilitate local instruction or 'business as usual,' but will exemplify one or more of the following ambitions:

• Address educational problems not remediable by traditional means or media -- Eg., the opportunity for realistic, hands-on problem solving in general education curricula; eg., by providing real data and inquisitorial tools in history curricula that allow students to explore, generate and test their own hypotheses rather than merely contemplate the deliverances of secondary analysis by others.

• Facilitate intellectual activities, skills, or sensibilities not well promoted by traditional means or media -- Eg., skills of moral reasoning and imagination that require exercise and testing against complex, realistic data; eg., by providing simulated clinical settings with 'real' and dramatic case material on controversial issues via interactive videodisc.
Motivate critical and creative re-thinking of our conventional wisdom about what's important to learn and how to expedite it -- Eg., the academic study of 'applied' ethics as opposed to simulated clinical or 'real life' experience via interactive or video case studies.

Among the project area reports separately provided herewith are reports on Pew-supported applications of technology, the strategic vision behind these innovations, and the integration of educational applications of computing in the College of Humanities & Social Sciences in particular. The following are also useful references on Carnegie Mellon's Andrew project in comparative perspective with technological advances and campus computing plans nation-wide:


Critical mass in critical areas. University Studies has attempted to generate a critical mass of innovative curricula that expand the option sets for fulfilling university requirements, but with programmatic focus in the following three major areas of nationally recognized need (below). Curriculum development requires some programmatic plan and priorities. The priorities for University Studies answer to nationally prominent, complex problems posed for any institution or program of educational innovation. These are not exhaustive of what-all can, should, or will ultimately be the targeted problems for University Studies, but the following issues are of incontestable importance and our curricular development projects that address them fit well within the framework of the university's general education requirements:

1. The need and current failure of higher educational programs to address the so-called crisis in values (an arguably perennial rather than recent phenomenon) and the skills and knowledge required to think rigorously about values and normative issues across the spectrum of human inquiry and practical life.

2. The need to provide some analogue of the classical trivium, some common ground in skills, knowledge and understanding for students across the various cultural and disciplinary divides endemic to our pluralistic society and an age of information explosion and inevitable specialization.

3. In particular, the need to define and provide both ordinary and new species of basic literacy in native, foreign, artificial, or technical language; not merely as a mechanical matter, but as integral to the competent use of language (both natural and artificial) for learning, inquiry, and communication across the daunting spectrum of the arts, sciences, technology, and cultures.

University Studies attempts to articulate and address these problem areas with curriculum and integral technology development projects that cohere under three programmatic themes:
Programs & Projects

1. VALUES in the Arts, Sciences, Society and Technology (VAST).

This area of development places priority on curricula that expressly feature value-laden issues endemic to human life and inquiry across the spectrum of the arts, sciences and technology: perspectives and methods for wrestling with value controversies and normative disputes, not just courses in ethics and social policy. The possible scope, as the acronym says, is VAST.

New programs:

One major outcome of this focus is the new Center for the Advancement of Applied Ethics (CAAE), established in June 1988, which has already developed dozens of workshops with corporations and government agencies. Case materials collaboratively developed 'in the field' are exploited in university curricula (e.g., Ethical Issues in Management, below). The CAAE thus functions as a two-way channel between the world of professional practice and curriculum development in the groves of academe. Organizations with whom programs have been collaboratively developed to date include:

- The Internal Revenue Service
- The U. S. Department of Agriculture
- The Easter Seal Society
- Aluminum Company of America
- Westinghouse Electric Corporation
- Duquesne Light Company
- The Edison Electric Institute
- Arthur Andersen & Company's Business Ethics PACE Program
- CMU School of Urban & Public Affairs Federal Executive Program
- CMU School of Urban & Public Affairs College Management Program
- University of Pittsburgh, Katz Graduate School of Business

The scope of the CAAE's concern includes not only business and government, but ethical issues endemic to practice in the arts, sciences and technological fields (e.g., software engineering) generally. For the broader mission and development plan of the CAAE, see:


Other generative outcomes are: the establishment of a Gender Studies Minor Program, which embraces social, ethical, cultural and methodological issues, and the University Scholars Seminar Program, focusing on value issues (the AIDS crisis will be the topic of the pilot seminar this year).
New curricula initiated or supported by University Studies in this area include:

- The Nuclear Age
- The Logic & Ethics of War & Peace
- Professions & Society
- The Meaning of Life
- Knowledge & Values
- Problems of Individual Liberty: Sex, Drugs, Rock 'n Roll, & Seat Belts
- Education, Ethics, & Values
- AIDS: Social, Ethical & Scientific Issues in Crisis
- World Hunger
- Computer Technology & Ethics
- Social & Ethical Issues in Computing (cross-listed in CLASP)
- Ethical Issues in Management
- Women & Inquiry: Values, Science, & Society
- Contemporary Moral Problems & Women
- Women in American History
- Sex & Gender in Literary Studies
- Race & Gender in World & American History

New educational applications of technology developed for values education:

- A Right to Die? The Case of Dax Cowart. Videotapes and an interactive videodisc for ethics course tested and used in five of the above courses. Certificate of Merit awarded in the 1988 University of Nebraska Videodisc Awards Program.

- Art or Forgery? The Case of Han Van Meegeren. An interactive videodisc developed and used in art and aesthetics courses.

- Birth or Abortion? The Human Face of a Dilemma. Videotape case studies and a prototype interactive videodisc (in development) for ethics and gender studies.
Reports on these seminal applications provided herewith or available include:

Covey, Preston K. New Media for Values Education. September, 1988.


2. METHODS of Inquiry, Design, Analysis, Synthesis (MIDAS).

This category of effort embraces basic staples of the liberal arts (quantitative methods, natural and social sciences, the humanities and fine arts) but with an express emphasis (already reflected in our established core curricula) on paradigmatic methods and modes of reasoning and inquiry.

A methodology is more than a method: a method is just a (well or ill defined) way of doing something; a methodology is a (tacit or explicit) normative 'theory' that rationalizes why one way of doing something is good or better than another. All MIDAS problems are then, at bottom, VAST problems. Literacy in basic and comparative methods of inquiry provide one crossroads, one common ground for communication and collaborative learning across disciplines and cultures.

New programs: There is a methodological emphasis in the Gender Studies Minor Program and curricula as well. A Film Studies Minor Program grew out of the critical mass of interdisciplinary faculty involvement in the observation and media projects.

New curricular initiatives in interdisciplinary, methodological studies include:

Symposium on the Role of Design in Liberal/Professional Education

Pattern & Design in the Arts & Sciences

Observation & Interpretation: Visual, Performing & Literary Arts

Observation & Interpretation: Picturing Others - Ethnography in Media

How Historians Think (also a designated writing course)

Reading Texts: Literary & Cultural Studies (also a designated writing course)

Logic & Artificial Intelligence

Technology & Literacy (cross-listed in CLASP: hands-on computer-intensive)

Computer Tools for Mathematical Problem Solving (cross-listed in CLASP)

Social Choice, Social Theory, & Computer Simulations
New seminal applications of technology developed for methods of inquiry include:

**The Great American History Machine** (GAHM). This application for mapping data and testing hypotheses developed generic machinery ('The Universal History Machine') adaptable to many domains of world history, geography, anthropology, sociology and macro-economics. *Distinguished Software Award* in the 1987 EDUCOM / NCRIP/AL Higher Education Software Award Program.

**PD World.** A simulation environment that allows a student to replicate or extend all extant research on n-person iterated prisoner's-dilemma-type models of the evolution of cooperative behavior and collective rationality. Used in philosophy, political science, policy, social psychology, decision science, economics and socio-biology courses.

**The CMU Proof Tutor & CSYM.** Intelligent Tutors designed for use as stand-alone learning environments and for integration into our on-line courseware for formal and applied logic designed to make formal logic accessible to the general student and applicable in many domains.

**The ModlForm Program.** Interactive instructional program and 'drafting table' for two-dimensional design, designed to make a simulated design studio accessible to non-professional students and to be integral to a computer-based 'distributed design studio.'

Reports on these seminal applications submitted herewith include:


3. LANGUAGE in the Arts, Sciences & Technology.

This area concerns literacy in both natural and artificial languages for learning, inquiry and communication. There are two major programs, concerned with writing and computing 'across the curriculum,' respectively:

**The Writing Across the Curriculum (WAC) Program.**

The vehicle & strategy for maintaining this program and expanding the impact of our effort to integrate writing as an endemic disciplinary and collaborative learning tool across colleges and departments is close on-going collaboration between English faculty and faculty in other departments on a course-by-course basis. The collaboration must be rooted in the research interests of English/writing faculty and the disciplinary culture and individual teaching agendas of the participating faculty. Manifold generic strategems low in time costs, high in yield for peer review, collaborative learning and integrating writing are adapted to different course settings and evaluated as part of on-going research in the English department. The results and case studies are shared with other faculty through University Teaching Center workshops and with other institutions through conferences and consulting by Professor Richard Young, coordinator for the program. WAC projects to date include lower & upper level courses in history, psychology, art, design, biology and mathematics.

University Studies also supported and evaluated an undergraduate Writing Fellows Program, employing student writing tutors in several large and small, lower and upper-level courses in the College of Humanities & Social Sciences, the College of Fine Arts, and the Mellon College of Science.

Reports on these programmatic activities submitted herewith or available include:

Bowen, Betsy Anne. *Talking About Writing: Collaborative Revision in the Peer Writing Conference.* Carnegie Mellon University, 1988. (Ms. Bowen was coordinator for two years of the Writing Fellows Program and this dissertation evolved out of that University Studies project, an example of integrating writing across the curriculum programs with research agendas.)


WAC curriculum development has been on two levels: (1) Courses that fulfill the basic university-wide writing requirement, either Strategies for Writing or designated writing courses (for Advanced Placement students) and (2) the integration of writing agendas and exercises in lower and upper level disciplinary courses that reinforce writing skills throughout the curriculum (per above). The following courses were newly developed for the basic university writing requirement:

- **Strategies for Writing** (required of all non-AP students; the courses below are writing-intensive designated writing courses)
- **Reading to Write**
- **Reading Texts**
- **Critical Writing**
- **How Historians Think**
- **Writing for the Professions**

Reports and publications on the innovations involved in these curricula include:

- Flower, Linda. Problem-Solving in Writing: Can We Teach 'Design' as a Cognitive Process? In Preston K. Covey (Ed.) *The Role of Design in Liberal/Professional Education*. August, 1988. (Professor Flower is coordinator and designer of Strategies for Writing, which teaches writing on a problem-solving, cognitive process model developed in collaboration with Professor John R. Hayes of the Psychology department, an example of the integration of writing with research.)


Applications of computer technology are integral to our WAC program and include:

- **The Notes Program** (exploiting the multi-window environment of the Andrew workstations for automatic indexing and dynamic linking of notes and texts).

- **The Comments Program** (exploiting both Andrew workstations and the network for collaborative learning and writing).

Reports submitted herewith on these innovative applications include:

The Computer Languages, Applications & Systems Program.

CLASP addresses a variety of problems in the mastery and use of artificial languages as tools for learning and inquiry across the spectrum of the arts and sciences, the need for computing literacy of many forms 'across the curriculum.'

CLASP represents a joint effort by the Center for Design of Educational Computing (CDEC) and University Studies (often in collaboration with other university units, like Academic Computing, the Software Engineering Institute or the Mathematics Department) to provide computing curricula that students want or need for general educational purposes but that are not provided by any department.

One example of the general education opportunities that can evolve from the interaction between natural and computational language studies followed the port by CDEC of Kyoto Common Lisp to the Andrew system, which, among other general education applications, supports a computer-based course in Interactive Fiction taken by both humanities and computer science students.

In addition to an introductory course in computer programming, all students at Carnegie Mellon are required to take a basic but exemplary computer literacy course, Computer Skills Workshop (CSW), that provides hands-on introduction to the computer systems, tools and concepts needed to exploit the rich and diverse computing resources of the university. CSW has evolved from a basic course on mainframe computing to personal computing to distributed computing on the campus network linking microcomputers, advanced-function workstations and the libraries' information systems. CSW is a major project of the University Studies / Core Curriculum project and a logistical marvel, with over 1200 students in a single semester. The university remodelled, equipped and dedicated a new wing of Baker Hall as an educational computing facility including TA offices, a computer-projection equipped amphitheater, and two computing labs.

New curricula under CLASP besides The Computer Skills Workshop include:

* Introduction to the Andrew System
* Prolog (on Andrew, PC's and the Macintosh)
* The cT / CMU Tutor Programming Language (on Andrew, PC's and the Macintosh)
* Design and Programming in HyperCard
* Introduction to Cobol (not taught in the Computer Science Department)
* Computing Tools for Mathematical Problem Solving
* Technology & Literacy (hands-on work with ancient and modern technologies)
* Computer-Based Instructional Design
* Formal Methods of Software Engineering
* Software Project Management
Computer tool development is crucial to integrating educational applications and use of computing into the academic lives of students and faculty across the curriculum.

The major tool development project supported by University Studies and the Center for Design of Educational Computing (CDEC) is the development of the cT programming language and authoring environment, now ready for wide distribution within and outside the university.

Beginning this year, cT is included in the Computer Skills Workshop for all students as well as in its own courses and workshops under CLASP.

CT (formerly, in prototype, called CMU Tutor) was designed to address certain strategic problems for faculty and student developers of educational applications, namely:

1. Difficulties and inefficiencies in learning and use.
2. Lack of support for modern graphical interfaces.
3. Lack of portability or compatibility across hardware and operating systems.

One singular achievement of cT is portability: the language and its applications run without change on popular (IBM and Macintosh) microcomputers as well as a variety of Unix workstations (Sun, DEC Micro VAX and IBM RT). Another is compatibility over time: cT / CMU Tutor programs written three years ago at its inception still run, despite changes in hardware and operating systems, thanks to automatic source code conversions.

Unlike conventional authoring languages, cT is a flexible general-purpose programming language; it trades off high-level authoring for flexible programming capabilities and extensibility, yet its "single most important virtue... is undoubtedly its accessibility to new users." Mark Resmer, former Director of Academic Computing at Vassar College, discusses the strategic significance and impact of cT (qua CMU Tutor). See:


On cT's strategic role in the wider integration of computer use in general education, see:


Faculty use cT for easy production of classroom interactions and presentations. See:

CT is, of course, typically used to construct sophisticated applications de novo. For example:

*Graphs & Tracks*, a simulation environment and intelligent tutor for introductory kinematics that won two EDUCOM/NCRIPタル awards in 1988 ("Best Physics Software" and "Best Integrated Software").

*Sketch*, an "intelligent" tutor for graphing algebraic equations and the largest program written in cT, won a 1987 EDUCOM/NCRIPタル Distinguished Educational Software Award. Other major educational applications built with cT are in use in a variety of disciplines and institutions.

*PD World*, a simulation environment built in cT for developing Prisoner-Dilemma-type models of the evolution of cooperative behavior, allows the replication or extention of all extant research in the field of social choice theory (thus putting a serious research tool in the hands of students as well as faculty). *PD World* is used in courses in philosophy, political science, decision science, economics, social psychology and socio-biology.

A diskette sampler for the Macintosh is available from CDEC containing a whole suite of programs written by physics faculty in cT. CT has been adopted by myriad faculty across the spectrum of the liberal arts, at Carnegie Mellon and other schools, for all these purposes and has become a cornerstone of Carnegie Mellon's long-term strategy for facilitating wider development of educational applications by faculty and students.

Design and development of educational applications of computing is a powerful educational experience for students. Given proper tools, students are certainly up to the challenge. CT is ideally suited for acquiring a knowledge of programming suitable for expeditious production of modest or very ambitious applications; it is a very expeditious route to deepening computer literacy beyond the use of computer systems and applications.

CT has in fact been used by students for the development of original educational software. Four stellar examples actually developed for use in undergraduate courses are *Chemistry Equation Solver* by David Thompson, *Chemical Design Editor* by Christopher Lewis, *Genetics Simulation Lab* by Pam Reinagle, and *Nuclear Power Plant Simulator* by Stuart Shapiro, winner of a 1987 Apple Computers, Inc. / InterUniversity Consortium for Educational Computing prize.

CT thus allows students to participate in original creative development on both popular microcomputers and advanced-function workstations. CLASP offers courses on design and programming in cT as well as instructional design generally to support this use. See:

*Scheftic, Carol. Students as Developers of Educational Computing Projects: Experiences from Carnegie Mellon University. Proceedings of the National Educational Computer Conference (NECC'88).*
Financial Report

Budget Summary & Narrative for 1985-86

I assumed responsibility for this project as Associate Vice President for Academic Affairs in the fall of 1986 (later to become Vice Provost for University Studies in 1987), after Andrew Achenbaum resigned from this position and stewardship to go to the University of Michigan. I have therefore isolated here the accounting for fiscal year 1985-86, the period before it was my responsibility. This summary shows slightly less expenditure than the August 15, 1986 report prepared in Achenbaum's behalf by the Development Office, because of encumbrances reported that were not after all expended:

<table>
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<tr>
<th>Income</th>
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<tr>
<td>Expenditures</td>
<td>242,000</td>
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<td>Balance Forward</td>
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</table>

Writing Fellows Program 46,000
Writing Across the Curriculum Seminars 42,651
WAC Computer-Assist Initiatives 8,740
Nuclear Age Interdisciplinary Course 31,000
Professions & Society Course 64,346
Design Symposium and Course 26,000
Observations Course 23,263

These projects and costs reflect very heavy amounts of faculty release time and graduate assistant support. This is an understandable practice at the heady beginnings of such a project, but I judged this level of funding for curriculum preparation projects (especially absent any special costs for technology development) as inappropriate and infeasible for the resources available. I consequently renegotiated some of the committed encumbrances (hence lower expenditures than reported in August '86) and established the following principles for future spending:

(1) While some release time for preparation of new courses, especially interdisciplinary ones, is reasonable, funds should be dedicated to new marginal costs (above course preparation) and costly resources that we do not already have or control (unlike faculty, whose job it is to prepare and teach courses)—for example, programmer support or TA's for courses (like Computer Skills Workshop or writing courses, whose audiences were expanding radically as these courses were required of ever more students). (2) Internal maintenance plans must be found for projects with significant marginal costs of these types, such that their impact will survive after funding ends.
## Budget Summary 1986 - 89

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<th>1986-87</th>
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<td><strong>Income</strong></td>
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**Administration**
- VP @ 1/4 FY
- January Term Study
- 17,885
- 18,896
- 2,977

**LANGUAGE in the Arts, Sciences & Technology**

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<td>95,056</td>
<td>45,630</td>
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<td>R. Young, WAC Coordinator @ 1/4 AY</td>
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<td>D. Kaufer @ 1/4 AY</td>
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<td>C. Neuwirth @ 1/4 AY</td>
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<td>FTE Programmer Notes &amp; Comments</td>
<td>20,815</td>
<td>34,300</td>
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<td>Grad Research Assistant(s)</td>
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<td>Benefits</td>
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<td>B. Bowen, Writing Fellows Program Coord.</td>
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<td>Undergraduate Writing Fellows (2 semesters)</td>
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<td>Reading Texts faculty (4 sections)</td>
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**Computing Across the Curriculum**

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<td>CSW Director @ 1/3 FY (J. Stuckey)</td>
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<td>CSW Teaching Assistants/Materials Developers</td>
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<td>CT development and support (K. Whittle)</td>
<td></td>
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<td>38,273</td>
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**VALUES in the Arts, Sciences, Society**

<table>
<thead>
<tr>
<th>Project</th>
<th>1986-87</th>
<th>1987-88</th>
<th>1988-89</th>
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<tbody>
<tr>
<td>Project THEORIA - New media for values education:</td>
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<tr>
<td>A Right to Die? - Ethics videodisc</td>
<td>2,600</td>
<td>9,050</td>
<td>6,000</td>
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<td>Birth or Abortion? - Ethics videodisc</td>
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<td></td>
<td>4,772</td>
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<td>Art or Forgery? - Esthetics/Art videodisc</td>
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<td>5,143</td>
<td>4,000</td>
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<td>The Nuclear Age</td>
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<td>Contemp Moral Problems &amp; Women</td>
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<tr>
<td>AIDS: Social, Ethical, Scientific Issues</td>
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<td>Ethical Issues in Management</td>
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<tr>
<td>Social &amp; Ethical Issues in Computing</td>
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<td></td>
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<tr>
<td>The Logic &amp; Ethics of War &amp; Peace</td>
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<td></td>
<td>3,524</td>
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<tr>
<td>Education, Ethics &amp; Values</td>
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**METHODS of Inquiry/Design**

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<th>1987-88</th>
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<tr>
<td>Role of Design in Liberal/Prof. Educ.</td>
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<td>Distributed Design Studio Computer Aids</td>
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<td>How Historians Think</td>
<td>20,729</td>
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<tr>
<td>Observation in the Arts &amp; Sciences</td>
<td>4,500</td>
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<tr>
<td>The Great American History Machine</td>
<td>13,900</td>
<td>25,509</td>
<td>10,850</td>
</tr>
<tr>
<td>Formal &amp; Applied Logic Computer Tutors</td>
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<tr>
<td>Logic &amp; Artificial Intelligence</td>
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<td></td>
<td>2,648</td>
</tr>
<tr>
<td>Social Theory &amp; Computer Simulations PD World</td>
<td></td>
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<td>8,165</td>
</tr>
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</table>
Budget Narrative 1986-89

This narrative, providing rationale and explanation, proceeds by project area and projects and, within those, by year chronologically. Funds accounted in 1988-89 are hard figures and have been disbursed as grants to projects, in order to clear the university Pew account by September 1988. The dollar discrepancy in the final 1988-89 balance is a round-off artifact.

General observations: Average expenditures per course or project decrease significantly from the first year (1985-86) through the subsequent three years. There were seven projects (a course, program or product) including four courses in 1985-86 at average costs of $34.5K and $36K, respectively. Over the subsequent three years, these average costs are $17K and $8 K. Over the four years and areas of programmatic focus, we have roughly the following commitments:

- $275K writing programs
- $128K computer literacy projects
- $165K interdisciplinary values projects
- $182K interdisciplinary methods projects.

The breakdown of curriculum versus technology development projects is $501K versus $249K.

I have made every effort to support only exemplary projects with lasting outcomes or 'products' exportable to other contexts and institutions. For example: All the allied technology development projects support innovative curricula and pedagogy in a variety of domains and course settings and are either in distribution or bound for wide export at other institutions; these carry our educational and curricular innovations abroad in animated form. The Center for the Advancement of Applied Ethics will perpetuate the focus we have built on ethics and values and work to expand attention to these matters within and outside the university. Computer Skills Workshop is now fully established with its own budget and new teaching facility, as a model for teaching basic computer literacy in a rapidly advancing multi-system, distributed computing environment.

The general principles I have tried to follow in the allocation of support are: To give priority to resources for innovation that we do not already have at hand (eg., programmers), and to junior faculty over senior faculty for release time. To keep release time for new course preparation reasonable and to support development work that entails exportable product (eg., new software, the writing and Computer Skills Workshop textbooks) more heavily than course planning. To insist that projects develop a maintenance plan, or a plan for closure or follow-on funding, for the time when present funding runs out.

The criteria for technology development projects were articulated above (p. 5) and have been well satisfied in every case: all ten projects (at an average cost of $25K) exemplify applications of technology that address important general education goals that could not be achieved without the technology. They have also provided important crucibles for careful, critical, and creative rethinking of our educational goals and practice.

As a result, I believe the cost control and cost effectiveness of our work since 1985-86 have been optimal.
0. Administration

As Vice Provost for University Studies (originally Associate Vice President for Academic Affairs) and Principal Investigator (PI) on the University Studies / Core Curriculum project, I have acted as a PI: that is, I have taken very active, hands-on responsibility for the direction and development of all the project plans and activities. I charged 25% of my salary in my first two years (1986-87, '87-88) for stewardship of the enterprise and substantive participation as project director in several of the projects: The WARRANT project, which developed the Notes and Comments programs for WAC (Christine Neuwirth has now taken over as project director); the design symposium volume and curricula study; Project THEORIA, which is developing the three videodiscs for ethics and art; the new Center for the Advancement of Applied Ethics; CLASP and the Computer Skills Workshop (since 1986-87, when the previous course director left); and the intelligent tutors project in formal and applied logic. I also participate in the collaborative design and negotiation of all the ethics and values courses. I continue in all these capacities, but University Studies now provides half salary support for leading its activities and projects.

In the summer of 1987, I supported a faculty member for one summer month to research and co-author a report on January Terms at other institutions, to inform our deliberations and proposal for establishing a January Term dedicated to general education at Carnegie Mellon. The January Term proposal, with the report I commissioned and a spreadsheet calendar model I devised, are now on the agenda of the University Education Council for AY 1988-89.

1. LANGUAGE in the Arts, Sciences & Technology

The Writing Across the Curriculum Program

Professor Richard Young is the coordinator for Writing Across the Curriculum. Professor Young has done research on Writing Across the Curriculum world-wide, was English Department Head during the building of the Rhetoric Program, and is a world-class researcher in the theory and teaching of writing. Young was supported one-quarter time in 1986-87. Continued quarter-time release for WAC coordination has since been provided by University Studies, a sign of the impetus and commitment to what Pew began. Young was provided with graduate student research assistants in 1986-87 and 1987-88 to help conduct evaluation studies of courses in which WAC strategems were employed.

Professors David Kaufer and Christine Neuwirth were also provided quarter time release to work on (1) the WARRANT Project, which developed the Notes and Comments programs for computer support of WAC, (2) the development of Critical Writing as a new designated writing course, and (3) a textbook to complement and export the innovative theory and practice embodied in their software and curriculum, The Architecture of Argument: Exploring Issues Through Reading and Writing (with Cheryl Geisler - Harcourt, Brace & Jovanovich, in press).

One full-time programmer has been provided each of the three years for the WARRANT Project: Learner Centered Environments for Critical Reading, Reasoning and Writing. The Notes and Comments programs have been deployed in sections of Strategies of Writing and Critical Writing from 1986-87. The programs have also been deployed in the writing program at UC Berkeley and other institutions. They will be used to support WAC activities in courses in other colleges, such as the two semester Experimental Biology sequence.
The Writing Fellows Program began in 1985-86 on a fairly ambitious and expensive basis. In 1986-87, Richard Young and I decided to trim the program back to pilot program proportions for evaluation of efficacy and cost effectiveness over two years. A graduate coordinator for 1986-87 and stipends for the undergraduate writing fellows for 1986-87 and '87-88 were provided for several courses. Departments provided with this service during these years are responsible for continuing support for the writing fellows.

Four faculty were supported to develop and teach four pilot sections of *Reading Texts* as a new designated writing course and H&SS 'basic skills and methods' core course in 1986-87. This course has since become a staple of the core curriculum and designated writing course options. The textbook for the course came out in late 1987: Gary Waller and Kathleen McCormick, *Reading Texts* (D.C. Heath).

**The Computing Across the Curriculum Program**

The major efforts to enhance computer literacy and use 'across the curriculum' have been (1) the Computer Skills Workshop, the largest course on campus and the only single course required of all students; (2) other courses developed under the aegis of the Computer Language, Applications & Systems Program (above); and (3) the development of the cT programming language and authoring environment as a powerful but easy to learn and use tool (like HyperCard, but its applications are portable across hardware and operating systems) for faculty and students to develop a knowledge of programming as well as educational applications without having to master a difficult programming language.

In the first year that the Computer Skills Workshop (CSW) became a strict requirement for all students university-wide (1986-87), its agenda began to expand to include a greater variety of microcomputer systems and software. CSW had previously been an elective course without the obligation to introduce all students to the major computing systems and utilities supported on campus. A tremendous logistical and planning effort was required to ramp the course up to speed. Consequently, in 1986-87, major time for a course director and administrative staff was provided as well as extra teaching assistants and materials developers. In 1987-88, CSW incorporated the Andrew system and workstations as well as the network and distributed file system in its already pregnant agenda. Better and additional instructional materials were required as well as new media (videotape and slides). Again, extra labor during the academic year and summer was required to produce materials to the revised course plan. The University Studies budget was expanded to cover administrative staff and the Vice Provost took over as course director (John Stuckey, the previous director, left in January 1987 for a position at Northeastern University). As of 1988-89, materials and course development has stabilized and the new University Studies budget is expected to be adequate to the work required.

The variety of other CLASP courses generated in the last two years (see above) have all been negotiated by the Vice Provost at no marginal cost.

For 1988-89, a full-time programmer has been committed to 'productization' and support of cT. This year the Macintosh version of cT has just begun distribution nationally as well as across campus; it will therefore require dedicated support. The additional programmer will also expedite and guarantee that the new IBM PS/2, MS Windows, and X-Windows versions for Unix workstations will soon follow suit. Courses and workshops will be given in cT this year under CLASP. CT is also included this year for the first time in CSW.
2. VALUES in the Arts, Sciences, Society, & Technology

Projects include allied curriculum and technology development.

Technology: Project THEORIA (Testing Hypotheses in Ethics/Esthetics: Exploration of the Roles of Observation, Rationality, Imagination & Affect) is described in my report *New Media for Values Education*. It involves the development of three interactive multi-media environments, for use in a variety of ethics, art and gender studies curricula. Two of these (the right to die and art forgery videodiscs) received seed support in 1986-87 and development support for faculty researchers/designers in 1987-88.

This accomplished the 'proof of concept,' prototype phase of development, at which point the right to die videodisc was awarded a Certificate of Merit in the 1988 University of Nebraska Videodisc Award program, the major national competition in all categories of videodisc. Both discs have been invited and shown at several national conferences in every relevant field.

In 1988-89, the third multi-media project (based on a book, with videotapes and videodisc) will be supported through the prototype, 'proof of concept' phase and the other two videodisc programs will be reimplemented in cT to allow their use across IBM PC, Macintosh and Unix workstation based systems, to expand the available installed base for distribution and site testing in medical schools and museums as well as other universities. The University of Utah Medical School will be making a version of the right to die videodisc program for 'low end' PC's.

These projects are totally unique in the application of videodisc technology to reasoning skills in the study of ethics and art; they exemplify seminal and strategic uses of educational technology.

Both discs have been tested and used with students in various courses in the 'Humanistic & Social Values' area requirement of the core curriculum, including new courses developed under this project: Observation & Interpretation: Visual, Performing & Literary Arts (Aesthetics), Knowledge & Values, Problems of Individual Liberty, and Contemporary Moral Problems & Women. The right to die videodisc will also be used experimentally in the Critical Writing course.

The low cost of development to date derives from the amount of dedicated support from CDEC, my own time as designer and project director, and other faculty. To become production-level products for commercial distribution they will require additional funding.

Curriculum: Faculty were supported at 1/12-time for development of Contemporary Morar Problems & Women (which exploits recent gender studies literature on moral reasoning and development), Ethical Issues in Management (targeted especially at Industrial Administration and Public Policy & Management students, exploiting case materials from the CAAE's field work), Social & Ethical Issues in Computing (co-taught with the Director of Academic Computing), The Logic & Ethics of War & Peace (co-taught by a philosopher and a University Professor in physics) and Education, Ethics & Values (which exploits recent studies and best-selling books interpreting the crises of higher education as well as classical texts).

Junior faculty coordinators were supported at 1/4 time for the interdisciplinary course and pilot University Scholars Seminar: The Nuclear Age and AIDS: Social, Ethical & Scientific Issues in Crisis (co-taught pro bono by the Dean of H&SS and the heads of the Biological Sciences and Social & Decision Sciences departments, as an example to other senior faculty).
3. METHODS of Inquiry, Design, Analysis, Synthesis

In January 1986 a university symposium was held on *The Role of Design in Liberal/Professional Education*. I inherited the set of symposium papers by Carnegie Mellon faculty and commissioned several more to produce a volume of the same title, a study in the manifold interdisciplinary dimensions of design as a unifying topic across the arts, sciences, and technological fields. I provided modest stipends to contributors and hired a free-lance editor to process the manuscripts in 1986-87 through 1987-88, resulting in the volume by that title submitted herewith (minus my introduction and previous Senior Vice President Pat Crecine's papers).

The *Distributed Design Studio* project supported a senior design professor and graduate students (the latter in the summers of 1986 and 1987) to (1) do a study of views from prominent senior faculty across the arts, sciences and engineering colleges on the design of interdisciplinary design curricula and (2) develop a prototype computer-based design environment, eventually to be integrated in a 'distributed design studio' on our campus workstations and network (based on the WAC project's *Comments* program) to make simulated hands-on studio experience more available to non-professional students. An interim report was produced on the study and the resulting ModiForm program prototype in July 1987. This project has inspired Professor Ballay to begin a textbook for teaching design and to incorporate our WAC techniques into his design curricula.

*How Historians Think* was a six section designated writing course emphasizing historical methodology. The development of this course provided support for a senior faculty coordinator, a University Teaching Center consultant and several graduate teaching assistants over two semesters in 1986-87. The course has since become a core contribution and fixture of the History department.

The *Observation & Interpretation in the Arts & Sciences* supported the addition of literary and performing arts modules, with several guest lectures and performances in dance and music, to an aesthetics course that previously focused on visual arts.

*Logic & Artificial Intelligence* and *Social Theory & Computer Simulations* supported faculty at 1/12-time to integrate software and computing exercises into the study of the design of artificially intelligent systems and formal models of social institutions and their evolution, respectively. The *Social Theory & Computer Simulations* project also provides partial support for a programmer to put *PD World* in final competition form for the 1989 EDUCOM / NCRIPTEL Higher Education Software Awards program. This simulation environment allows the replication and extension of prisoner-dilemma models of the evolution of cooperative behavior and collective rationality -- it puts serious research tools in the hands of students. It has been used and distributed for courses in philosophy, political science, social & decision science, economics and socio-biology. Because it is written in cT, it is extensible and portable across hardware systems.

*The Great American History Machine* project, whose seminal and strategic use is described at length in its separate report, supported 50%, 100% and then 30% of a programmer over three years. It won the Distinguished Software Award in the 1987 EDUCOM / NCRIPTEL competition.

*The Intelligent Tutors for Formal & Applied Logic* project is the leading project nationally in its field, integrating AI research with educational design. The tutors are written in Lisp with interfaces written in cT for integration with our on-line logic course or stand-alone. 75% of a programmer is supported this year to put the tutors in form for the 1989 EDUCOM competition.
Appendix

List of Available Reports & Publications


Bowen, Betsy Anne. (Diss.) Talking About Writing: Collaborative Revision in the Peer Writing Conference. Carnegie Mellon University, 1988. (Ms. Bowen was coordinator for two years of the Writing Fellows Program and this dissertation evolved out of that University Studies project, integrating writing across the curriculum programs with research.)


Covey, Preston K. The January Term Project. September 1987.


Covey, Preston K. Prospectus for the Center for the Advancement of Applied Ethics. March 1988.


Covey, P., Roberts, S. & Spies, N. (June, 1988). *A Right to Die? The Case of Dax Cowart.* A videotape demonstrating the videodisc submitted to the University of Nebraska 1988 Interactive Videodisc Awards program. 1/2” VHS and 3/4” Beta formats. (The videodisc was awarded a Certificate of Merit in July 1988.)


Covey, Preston K. (Ed.) *The Role of Design in Liberal/Professional Education.* August 1988.

Covey, Preston K. New Media & Values Education. For the Alfred P. Sloan Foundation Conference A Critical Examination of Technology in Higher Education: Importing "Real World "Information, Dartmouth College, September 30, 1988.

Flower, Linda. Problem-Solving in Writing: Can We Teach 'Design' as a Cognitive Process? In Preston K. Covey (Ed.) *The Role of Design in Liberal/Professional Education.* August, 1988. (Professor Flower is coordinator and designer of Strategies for Writing, which teaches writing on a problem-solving, cognitive process model developed in collaboration with Professor John R. Hayes of the Psychology department, an example of the integration of writing with research.)


Shriver, Karen. Writing Across the Curriculum at CMU. December, 1986.


