TEACHERS COLLEGE

COLUMBIA UNIVERSITY

COMMUNICATION, COMPUTING, AND TECHNOLOGY IN EDUCATION

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PROGRAM FACULTY

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- **Communication and Education** (Code: TUC)
  Degrees Offered: M.A., Ed.M., Ed.D.
- **Computing and Education** (Code: TUD)
  Degree Offered: M.A.
- **Instructional Technology and Media** (Code: TUT)
  Degrees Offered: M.A., Ed.M., Ed.D.

COMMUNICATION, COMPUTING, AND TECHNOLOGY IN EDUCATION

Graduate Studies in Educational Informatics

COMMUNICATION, COMPUTING, AND TECHNOLOGY IN EDUCATION provides a cluster of degree programs for students who seek to develop leadership capacities in the uses of information and communication technologies in education. It serves students, staff, and faculty members who share a commitment as educators to use digital technologies to improve education at all levels. Work through CCTE should move simultaneously towards two poles of understanding and practice -- towards comprehending the cultural and historical implications of new technologies for education and life, and towards purposefully selecting and shaping the uses of new media in educational work at all levels.

CCTE's programs deal with the many ways in which material culture changes and shapes educational practice at all its levels. Here are some assumptions about the long-run effects that innovations in information and communications technologies may be having on education and culture. Work through CCTE should lead faculty and students to study, criticize, develop, and extend propositions such as these.

- When changes in information and communications technologies transform the ways people create, disseminate, and apply knowledge, deep changes in educational practices occur.
- Educational institutions, including schools of education, will undergo prolonged change and significant transformation, occasioned by changes in the means and the media of intellectual production.
- As digital information and communications technologies develop, the separation of the elementary and secondary schools and the institutions of higher education into two, largely distinct, educational cultures will markedly diminish.
- With the emerging intellectual conditions, activities contributing to the creation of knowledge will increase in relative value and those devoted solely to its dissemination will decrease.
- Campuses will remain important foci of intellectual activity while participation in them will become more flexible via networks supporting asynchronous, distributed study and teaching.
- Specialists in education will need to work closely with scholars, scientists, and professionals to embed powerful learning experiences in the digital means for advancing knowledge.
- Increasingly, educators will de-emphasize imparting a static stock of information and ideas and will instead seek to enable all people to contribute to the advancement of knowledge.
- Demand for highly skilled educators will increase and preparing them will largely be a field-based engagement in situations where students interact with new knowledge resources.
- Schools and other educational institutions will increase in public importance and the educating professions will increasingly become high-tech and high-prestige professions.
- Changes in information and communications technologies will resuscitate the progressive movement in education, enabling it to be both broadly egalitarian and intellectually rigorous.

COMMUNICATION, COMPUTING, AND TECHNOLOGY IN EDUCATION aims to prepare students to deal with both the present and future implications of new media, and to play a constructive role in shaping the educational response to innovations in information and communications technologies. Although these concerns are common to its three programs, each has distinctive nuances with respect to methods and purpose:

- Communication and Education relies primarily on social science inquiry to understand, interpret, and shape how information and communications technologies influence culture and education;
- Computing and Education works with computer information systems to facilitate the effective extension of digital technologies into educational practice;

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- Instructional Technology and Media concentrates on the creation and application of innovative technologies, guided primarily by research in pedagogy and cognitive science, in order to make new media work as powerful tools for study and teaching.

Across the three programs, students and faculty members all engage in research, development, theory, and application. All three programs put a high priority on group work, on field work and internships, and on planning, implementing, and completing innovative projects. Schools, computer companies, businesses, and other agencies are normally partners in projects, providing environments, materials, personnel, or opportunities for carrying them out. The Institute for Learning Technologies (www.ilt.columbia.edu), the Center for Technology and School Change (www.tc.columbia.edu/~academic/ctsc/), and the Columbia Center for New Media Teaching and Learning (www.ccnmtl.columbia.edu) work closely with CCTE faculty members and students and provide a wide range of internship and fieldwork opportunities.

Communication and Education (M.A., Ed.M., Ed.D.)

Through the program in Communication and Education, students prepare for work in schools using information and communications technologies as means for improving educational practice; for careers as innovators in the design and use of new media for educational purposes; for teaching and research positions in higher education; for conducting formative and evaluative research in the areas of educational media and information technologies; and for work in business and government designing and implementing corporate communication programs. The program uses the methods of the social sciences, encompassing both qualitative and quantitative approaches to the study of communication and education. Faculty members and students ask, in particular, How do education and other social systems change under the impact of new media? They pursue three broad areas of inquiry, enabling them to:

- Reflect on the historical effects of media and on the cultural uses of developments such as face-to-face speech, writing, printing, photography, film, radio, television, computers, and networked multimedia;
- Use anthropological and linguistic methods to study how the diverse forms of communication, information processing, and cognition condition educational practice.
- Explore positive and negative effects of media on social relations and develop strategies for using information and communications technologies to improve conditions of education and life.

In the course of completing a degree, the student should expect to attend closely to both technical artifacts and to human activity; that is, both to material systems of communication in which technologies are the matter of primary interest and to interpersonal, direct communication dynamics in which unmediated exchanges, face-to-face, are the subject of inquiry. A major theme for continuous reflection should be the diverse ways in which the modes of communication condition the meanings actually and potentially communicated, whether in face-to-face conversation or through a global broadcast using satellite transmission.

Computing and Education (M.A.)

Students who complete the Masters Program in Computing and Education take positions in schools as computer coordinators or teachers using advanced technologies in the classroom, in new media companies developing software and multimedia applications for education and training, in academic computer centers and corporate information services, and in education departments at the federal, state, and local levels managing the integration of information and communications technologies into schools.

Within the general area of computing and education, faculty members and students study the interactions between computing and education, interactions that grow ever more powerful and diverse.

Some students in the program aim to improve how computing, including programming, is taught in schools, and in this area students make special efforts to address the need for appropriate software throughout education and the search for appropriate pedagogies for teaching computing at diverse levels, from early childhood through maturity. A growing number of students concentrate on the uses of computers and the Internet as tools pervading the school program. What are the appropriate patterns of use for computers at various levels of formal education? Can educators develop and implement computer use in education, paying attention to matters of equity, pedagogical value, and the productive allocation of scarce educational resources? Students in this program should master the skills needed to design, implement, and manage the substantive uses of digital telecommunications systems for educational purposes.

Instructional Technology and Media (M.A., Ed.M., Ed.D.)

Students who have earned degrees in Instructional Technology and Media find positions in education, government, and industry. Some continue to work within formal education, as teachers, researchers, or administrators on the elementary, secondary, or college level. Others work in training and development departments in business or government agencies. An increasing number work as independent professionals in a variety of settings, such as educational service, production consulting, and publishing. Still others have established themselves as researchers, designers, and producers for innovative new media companies, large and small..

In recent years, students in the program have made four questions paramount:

- Which emerging technologies hold greatest promise for enriching the learning experience throughout the educational enterprise?
- What pedagogical strategies should designers embody in instructional materials, including those based on multimedia?

- How should educators deploy, manage, and evaluate information and communications technologies in classrooms for optimal educational effect?
- What principles of design and practice should educators incorporate into distributed educational courses and programs?

The World Wide Web and related technologies have lowered the costs of distance learning programs greatly while increasing their flexibility. Through Instructional Technology and Media faculty members and students join to develop the skills needed to make full use of the new opportunities in distance and distributed learning.

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Participants in the three CCTE program areas share a basic conviction that good design in educative matters starts with careful attention to the needs and characteristics of the students that the design will serve. The ability to understand the student, through empirical research and empathic engagement will make the the educational uses of information and communications technologies not only technically proficient, but educationally valuable as well. In all, this attention to the student defines the technological humanism we seek through all components of the programs in COMMUNICATION, COMPUTING, AND TECHNOLOGY IN EDUCATION, a technological humanism that combines sophistication in the use of technical means with humane commitments for guiding purposes.

Special Application Requirements/Information:

- CCTE reviews M.A. and Ed.M. applications on an ongoing basis. For scholarship awards, applicants who meet the priority deadlines receive preference (February 1 for Summer and Fall and November 1 for Spring), with most aid going to doctoral students who meet the February 1 deadline.
- CCTE requires doctoral applicants to submit a writing sample and results from the GRE General Test. We strongly encourage doctoral applicants to arrange for an interview. CCTE reviews doctoral applications once a year in late February with the expectation that doctoral students will start during the Summer or Fall sessions. Consequently, doctoral candidates should meet the February 1 priority deadline for applications.
- In addition to academic criteria, CCTE takes into account the relevance of its resources to a prospective student's professional goals as described in the personal statement in making admission decisions.

Financial Aid and Other Assistance:

In addition to college-wide financial aid opportunities and student services, the faculty members of COMMUNICATION, COMPUTING, AND TECHNOLOGY IN EDUCATION are committed to generating an increasing range of opportunities for remunerative work that will integrate well into our program of studies. Essentially such opportunities are of three types: assistantships in research and development projects, instructorships to teach basic courses in our field, and internships in industry, government, and education. The precise opportunities that exist in these areas continually change as projects, here and elsewhere, begin, proceed, and culminate. To find out about these opportunities, students should consult individual faculty members.

Recommended Studies:

Formal recommendations should not determine the course of study a student will take; they should help structure the type and character of student choices. The *Teachers College, Columbia University 2000-2001 Bulletin* states college-wide degree requirements on pages 228-230. The following description of steps through programs specific to COMMUNICATION, COMPUTING, AND TECHNOLOGY IN EDUCATION amplifies the college-wide requirements and should serve as an aid for structuring an individualized program of study based on previous experience, professional goals, and interests. Enrolled students can obtain further specifics about options and the academic calendar from the program office, Box 8, (212) 678-3344. Choosing a program of studies is a necessary, but not sufficient, way to a degree. Degrees represent advanced levels of mastery in rigorous scholarship and disciplined practice. In developing a program, students should find ways to meet the intrinsic demands of the field.

Master of Arts

To earn the Master of Arts degree, students must satisfactorily complete 32 points of course work and an integrative project, together roughly the equivalent of one calendar year of full-time academic work. Teachers College accepts no transfer credit for the M.A. degree. In CCTE's programs, the M.A. degree serves two main functions: in part as a mark of entry-level professional qualifications in the fields we cover, and in part as a grounding for further, more advanced specialization in the field. Students should consult with a faculty advisor and choose their courses with care in light of these functions.

Teachers College has a **breadth requirement**, which students fill by taking three TC courses, each for at least 2 points, outside the area of Communication, Computing and Technology (i.e., courses with a prefix other than MSTU).

Teachers College has a **major requirement**. In CCTE, M.A. candidates typically meet this by choosing courses that provide some breadth across our activities and other courses that form a concentration appropriate for their program area. Generally, each should take MSTU4000, Core Seminar in Communication, Computing, and Technology, as early in their program as possible. Each should define at least four courses as constituting a core concentration in his or her program area. In addition, each should identify at least one course especially pertinent in each of the other program areas. Each student should make these determinations, as appropriate to special circumstances arising from his or her interests and goals, from special skills or needs, or from scheduling constraints. Students should consult from time to time about course options with a faculty advisor.

In addition to course work, Teachers College has a **culmination requirement**. In CCTE, M.A. candidates culminate their program with an integrative project. This project should be an independent work, equivalent in effort to that devoted to a 3-point course. The best projects start with a concern of significance to the student. In planning an integrative project, a student should consult with a faculty advisor about its feasibility and appropriateness, usually by providing a brief prospectus of it for comment. Projects can take a wide variety of forms. For instance, such a project might be an evaluation of a program, a research design, a business plan, or a software design. It might be a review essay, in which the student gives a thorough, well-written summation of current research and development work in an area of his or her choice within the broad field of information and communications technologies in education or it could be a multimedia instructional application with a commentary on its pedagogical design. Whatever its form, the project should be a tangible work of value to the student after earning the degree.

In addition to meeting College-wide degree requirements, we recommend in CCTE that students take some Fieldwork or Internships as an integral part of their Masters program, for experientially grounded learning is an invaluable preparation for professional practice. We include further information on Fieldwork and Internships below.

Typical Core Program Courses

Communication and Education	Computing and Education	Instructional Technology & Media
MSTU4000: Core Seminar in Communication, Computing, and Technology in Education		
MSTU4010: Theories of communication	MSTU4022: Telecommunications, distance learning, and collaborative interchange	MSTU4008: Information technology and education
MSTU4016: History of communication	MSTU4031: Programming I (required of Computing and Education students who are not proficient programmers)	MSTU4083: Instructional design of educational technology
MSTU4018: Design & communication in modern culture	MSTU4052. Computers, problem solving, and cooperative learning	MSTU4133: Cognition and computers
MSTU4049: Computers and writing	MSTU4085: New technologies for learning	MSTU5020: Computer-mediated communication
ITSF5003: Communication and culture	MSTU4133: Cognition and computers	MSTU5030: Intelligent computer-assisted instruction
MSTU5020: Computer-mediated communication	MSTU5555: Technology and the emergence of a global curriculum	MSTU5510.01: Topical Seminar -- Design of distributed instruction

Master of Education

An Ed.M. degree represents roughly the equivalent of two years of full-time graduate work. It serves for some to mark progress towards a doctorate and for others to indicate intermediate professional qualifications for students who have previously completed a Master's degree at Teachers College or other institutions. Up to 30 points of graduate credit earned elsewhere may be counted toward the minimum 60-point requirement. Candidates for the Ed.M. who have not met the Teachers College **breadth requirement**. M.Ed. candidates who have completed an M.A. in CCTE, or an equivalent program, should select further courses to broaden and deepen their mastery of the field. Those who are transferring a significant number of points from a different specialty towards the M.Ed. should include a selection of CCTE core program courses in their remaining course work. In addition to completing the minimum course requirements and developing a skill specialization, candidates for the Ed.M. degree should culminate their work through a **research or development project** submitted to the faculty. Like the M.A. integrative project, it should result from independent effort equivalent to that for a 3-point course. This project should represent the student's interests well, one that allows him or her to display the specialized skills developed in study for the degree.

Students accepted for a doctoral program should earn the Ed.M. as an integral part of their doctoral work. The Ed.M. can be, however, far more than a stepping stone to a doctorate. It has great flexibility and students can use it to lay a strong foundation for significant positions of leadership that demand high levels of skill but do not require doctoral-level academic certification. For instance, students can put together a very effective 60-point program dealing with "school media for curriculum innovation." In a similar way, one can develop a very strong grounding in educational software development through the Ed.M. degree. It can serve many purposes: one needs to think through one's aspirations and use the scope of the Ed.M. program to build academic and experiential foundations for their achievement.

Doctor of Education

A program of study towards the doctorate in Communication, Computing, and Technology in Education includes basic courses, a skill concentration, and independent projects, all leading to the certification examination and to the dissertation. The following paragraphs describe the specific steps to the doctorate in Communication and Education and in

Instructional Technology and Media. These steps help students achieve three key results of effective doctoral study: developing autonomous command of one or more modes of inquiry, contributing professionally to a field through conferences, presentations, or publications, and participating actively in CCTE functions outside class work.

Students pursuing the Ed.D. degree should read "Requirements for the Degree of Doctor of Education," obtained from the Office of Doctoral Studies. It states the formal requirements for the degree and lays out the steps leading to it. Students should plan their programs individually in consultation with a faculty advisor, starting with the admission interview and initial writing assignments. Doctoral candidates should develop a systematic plan for study early in their program, encouraging sustained consideration of a dissertation area and tailoring course selection to support dissertation work. All students admitted to the doctoral program should maintain continuous 0-point registration in the doctoral colloquium, MSTU6600. This is a venue for group advisement, mutual support, preparation for the certification examination, exploration of dissertation topics, discussion of new publications and programs, and general collegial interaction. It will meet every third Thursday, from 7:00 to 9:00 during the academic year. The colloquium provides a sustaining context for advanced work with technology and education. The following discussion reflects on the purposes informing doctoral requirements and explains some of their sequence and mechanics. Through the colloquium, doctoral students can further clarify and concretize these.

Informing Purposes

A doctorate is the highest degree one can earn, the top of the academic ladder. In aspiring to the doctorate, one is aspiring to become the peer of the best practitioners of one's field, perhaps at first a bit less experienced than others are, but fully prepared and fully capable of independent professional self-direction. Since the doctorate represents the highest level of educational preparation achievable in the field, to complete it well, students should meet all requirements with a fullness and in an intellectual spirit consonant with this status. As educators seeking to use technology to improve education, we need simultaneously to advance knowledge and to improve practice, and we pursue these interrelated goals through research and development activities. Consequently, preparing for the doctorate requires a commitment to both knowledge and action. In preparing to meet doctoral requirements, you need to develop your capacities in both directions.

Consider, first, preparation for advancing knowledge. Doctoral work in CCTE draws from two scholarly sources: the study of communication and the cultural sciences on one side and the study of cognition and computational sciences on the other. In the course of preparing for the doctorate, students should acquire a good acquaintance with both of these sources and a high level of mastery in one of them. In addition, we expect doctoral candidates to develop an informed understanding of current policy issues affecting the uses of technology in education.

Communication and the cultural sciences. When people ask why information and communications technologies may have significance in education, one basic answer involves the way these technologies affect the constraints on communication and the exchange of information and ideas within educational institutions and cultural arrangements. Cultural conditions are significant determinants of educational possibilities and results. What conditions are significant? How are they changing? What may be the implications of these changes? How can we explain, interpret, and control these changes? Do the emerging conditions serve to improve the advancement of knowledge? Are they laden with pedagogical pollutants? Do they provide people with better opportunities to learn and with more powerful motivations to acquire knowledge, values, and understanding? Will they configure into a more effective educational system than the *status quo ante*? To answer such questions, scholars turn to the study of communicative actions and to their effects on cultural practices and educational work by teachers and students. The basic methods are those of philosophy and the social sciences -- anthropology, economics, history, political science, sociology. We need to understand new media as a force shaping the historical sociology of the educative enterprise. The practical outcome emerges as educators use their understanding to cultivate and improve the socio-cultural conditions of education, to provide students with intellectual environments that will better sustain their inquiries and development.

Key faculty members to consult with on communication and the cultural sciences include:

- John M. Broughton, Associate Professor of Psychology and Education
- Howard Budin, Adjunct Assistant Professor of Computing and Education
- James W. Carey, Professor of Journalism
- Clifford Hill, Arthur I. Gates Professor of Language and Education
- Jo Anne Kleifgen, Associate Professor of Linguistics and Education
- Hope J. Leichter, Elbenwood Professor of Education
- Robert McClintock, Professor of History and Education
- Frank A. Moretti, Research Associate Professor of Education
- Eli Noam, Professor of Business
- Robert P. Taylor, Associate Professor of Computing and Education
- Hervé Varenne, Professor of Education

Cognition and the computational sciences. As information and communications technologies alter constraining educational conditions, they may also enable the design and construction of more effective tools for teaching and study. Digital technologies are far more supple than their predecessors – the serve as a effective heuristic for research into cognition and learning, and they provide students at all levels with powerful tools of inquiry, problem-solving, and learning. Can educators present skills, ideas, and knowledge in more effective, memorable, and meaningful ways? How do people learn different reasoning strategies, acquire bodies of information, understand probabilities, solve problems and set goals? How can developers use models of cognition and thought to design effective learning environments? To answer such questions, researchers use cognitive, developmental, and behavioral studies to explore how children and adults learn, think, reason, and collaborate. The basic methods are those of experimental research and the construction of cognitive and computational models to investigate the mechanisms underlying thinking and learning. The practical outcome results in research-based

improvements in educational practices and in development of more effective educational software and learning environments.

Key faculty members who can advise on cognition and the computational sciences include:

- John B. Black, Professor of Computing and Education
- James E. Corter, Associate Professor of Psychology and Education
- Clea Fernandez, Assistant Professor of Psychology and Education
- Bernard Gifford. Sussman Visiting Professor of Technology and Education
- Herbert P. Ginsburg, Jacob H. Schiff Professor of Psychology and Education
- Deanne Kuhn, Professor of Psychology and Education
- Kathy McKeown, Professor of Computer Science
- Dolores Perin, Associate Professor of Psychology and Education
- Stephen T. Peverly, Associate Professor of Psychology and Education
- Ernst Z. Rothkopf, Cleveland E. Dodge Professor of Telecommunications and Education
- Joanna P. Williams, Professor of Psychology and Education

Policy issues in technology and education. Doctoral candidates, in effect, assert their readiness to exert public leadership with respect to the educational uses of information and communications technologies. This role requires that they be aware of the key policy issues bearing on the uses of technology in education. They will find themselves having to make decisions about the implications of digital technologies for intellectual property rights; about diverse federal, state, and local policies promoting and inhibiting the educational uses of technology; about how to balance First Amendment rights against community expectations that schools and libraries will enforce standards of decency and respect; about how to distribute the benefits of costly technologies equitably in communities riven by disparities of wealth and power. Doctoral study should included sustained attention to such issues.

Key faculty members to consult on policy issues bearing on technology and education include:

- Robert L. Crain, Professor of Sociology and Education
- Michael M. Crow, Professor of Public Affairs
- Jane C. Ginsburg, Morton L. Janklow Professor of Literary and Artistic Property Law
- Dale Mann, Professor of Education
- Robert McClintock, Professor of History and Education
- Bridget Nacos. Adjunct Assistant Professor of Political Science
- Richard R. Nelson, George Blumenthal Professor of Public Affairs
- Robert Shapiro, Professor of Political Science

Consider, second, preparation for professional action. Information and communications technologies are changing rapidly and they are having powerful effects on how people advance and disseminate knowledge. It is hard to achieve relevance to practice from disengaged, academic vantage points. We expect students to engage in the actualities of innovation and to pursue reflection and research while taking chances in the marketplace of practice. On-line program development; classroom innovations and their situated uses; professional development activities; assessment and evaluation work; infrastructure design and implementation: all these are the activities of Institutes and Centers where ideas about technology and education are put to the test of practice. A significant element of a doctoral student's preparation for advanced work should take the form of internships and fieldwork; individual and group project activity; managing implementation efforts; and project design and proposal writing. In a world of fast-moving innovation the empiricism of the laboratory is almost always a study of obsolescence. The more productive empiricism puts hypotheses to the test of practice. We expect doctoral students to master that art, turning it to both practical and intellectual benefit.

The Sequence of Requirements

On admission to a doctoral program, a student works on the first stage of earning the doctorate, which culminates in *certification* as a candidate for the doctoral degree. Following certification, the doctoral candidate must complete degree requirements and successfully propose, write, and defend a dissertation project. Leading up to certification, a student must submit a Program Plan and a Statement of Total Program, which the Office of Doctoral Studies uses as a kind of checklist to ensure that as the process proceeds formal requirements are in fact met. The student should complete this step in consultation with a faculty advisor and think through the rationale and coherence in the course work he or she has done and expects to do in the process of study. Such course work provides the foundation of doctoral study, a necessary but not sufficient part of the process. The key substantive components of the doctoral process, however, are certification and the dissertation.

Certification. What does "certification" certify? Essentially it certifies that in the judgment of the supervising faculty members a student has acquired the requisite skills, capacities, and preparation to earn the degree of Doctor of Education successfully. It certifies that a student has become a qualified candidate for the doctoral degree. One does not acquire certification by passively accumulating course credits and grades and the like, no matter how stellar those may be. A student secures certification by demonstrating achievements worthy of a candidate for the doctoral degree through performance on a comprehensive examination and on other measures deemed appropriate by the faculty.

The comprehensive examination consists of a six-hour test, administered once during the Fall, Spring, and Summer Sessions. Questions for a three-hour morning session pertain to the student's primary domain of scholarship -- communication and the cultural sciences or cognition and the computational sciences. Questions for the three-hour afternoon session are divided equally between the student's secondary domain of scholarship and the area of policy issues in technology and education. In conformance with College policy, a student should take the certification examination for the first time during the term he or she accumulates at least 70 points towards the doctoral degree. Students whose course program includes a substantial number of transfer credits often take the exam after they have accumulated a larger number of points. On taking the examination for the first time, it must be taken in its entirety. If a student passes one or more parts, but also fails one or

more, only those parts that he or she failed need be retaken. A student who does not pass all parts within three tries will be denied certification and his or her work towards the doctorate will cease. A student who passes all parts of the certification examination will have completed demonstration of his or her preparation for advancing knowledge in the field.

In addition, as a component of the certification process, the student should demonstrate his or her preparation for engaging in professional action by submitting a portfolio of project work. This should take place during the CCTE advisement meetings in the term in which the student completes the certification examination successfully. The portfolio should reflect a record of achievement and mastery of practical skills in research and development projects, showing evidence on the basis of which the faculty can expect the student to develop and carry a dissertation project to successful fruition. On favorable completion of this portfolio review, the student will have earned certification as a doctoral candidate and the faculty will request the candidate to form a dissertation committee, with a sponsor, and to propose a dissertation topic.

The Dissertation Project. Candidates for the doctorate often approach their dissertations in a manner that is too mechanical and perfunctory. A dissertation is a major commitment. Classically, a dissertation was a vehicle through which a doctoral candidate made an original contribution to the stock of knowledge in his or her field. The doctoral project for the Ed.D. is and should be somewhat more flexible and diversified than the classic dissertation. The range of this diversity is described in the Office of Doctoral Studies statement. All the same, whatever the exact form and substance of the dissertation, it will be the doctoral candidate's primary demonstration of capacity for working at the highest level in the field. The dissertation is a major act of professional self-definition. Employers rarely look, at the doctoral level, at course transcripts and grade-point averages. Rather they look at sustained demonstrations of achievement -- publications and projects completed. The dissertation is the doctoral candidate's best opportunity to define and carry out such a demonstration at a demanding level of achievement.

There is a formal process to doing a dissertation. The Office of Doctoral Studies description of the Ed.D. requirements explains this process. Here are some observations that may amplify that description.

Many doctoral students do not start work on their dissertations early enough. Preparation of the dissertation should begin long before a student has chosen his or her specific topic. It begins, not by choosing a topic, but by forming skills of research, inquiry, and expression, developing intellectual and professional confidence, standards, and style. Through the dissertation, a student should demonstrate that she has attained effective academic autonomy. She demonstrates academic autonomy by exercising the ability to identify a topic of significance, formulating and executing a strategy for advancing art and knowledge with respect to that topic, and convincing a committee of peers, autonomous professionals, that the work indeed advances the field. Prior to selecting a topic, each doctoral candidate needs to internalize the skills, techniques, and standards requisite for it. A dissertation is not a work done in dependency; it is evidence of independence and self-direction in one's field. Too many doctoral candidates approach the dissertation too passively, resolved to do whatever the authorities – the process and the faculty – require and expect. The authority embodied in a dissertation should be the authority an advanced student develops and asserts: the role of sponsor, committee member, and outside reader is not to imbue a tentative work with their superior authority, but to support, challenge, and recognize, as they see fit, the emergent authority the student has imparted to the work.

To do that, a candidate must propose a dissertation, defining what it is that he will do and describing how it will be done. In developing the proposal, students should pay close attention to the requirements on the protection of human subjects as administered by the Institutional Review Board (www.tc.columbia.edu/associate-dean/osp/hsubjects.html). These regulations need to be followed closely. Outside of these, a proposal is not like a contract, stipulating what the candidate is to do with the expectation that to complete the dissertation, he will execute each item in the proposal as the document prescribes. Rather, a proposal has a persuasive, demonstrative function. It needs to convince a dissertation sponsor, and at least one other serving as committee member, that the candidate has a worthwhile topic, a sound strategy for addressing it, and the commitment and skill needed to carry the work to successful completion. A dissertation proposal is one of the most transient literary forms that exist. A candidate should develop it in close consultation with a dissertation sponsor. It should serve effectively to get the work underway and to help keep it on track towards effective completion. Then its work is done and the dissertation will completely supplant it.

Completing the dissertation involves execution of the study or project and presentation of the results. Here the candidate is largely on her own. There is no magic formula. A common mistake doctoral candidates make is to look for one on which they can passively rely. By the time of the dissertation, a student should know what good scholarship looks like, appropriate to their interests and disciplinary commitments, by having read a lot of it and having thus formed defensible preferences. Dissertation guides and research handbooks can help her fulfill her goals, but they can also confine and inhibit the work. A student who looks to a handbook to find out what she should do should pause; she should know that independent of the handbook. A student who looks to the handbook for tips on accomplishing what she intends to do, help in managing time and effort, and insight into the reasons for accepted conventions and usage should benefit. Eviatar Zerubavel, *The Clockwork Muse: A Practical Guide to Writing Theses, Dissertations, and Books* (Cambridge: Harvard University Press, 1999) is especially useful for its tips on planning time. Thomas J. Long, John J. Convey, and Adele R. Chwalek, *Completing Dissertations in the Behavioral Sciences and Education: A Systematic Guide for Graduate Students* (San Francisco: Jossey-Bass, 1985) has many useful suggestions, especially for students whose dissertations will involve rigorous tests of hypotheses. Jacques Barzun and Henry F. Graff, *The Modern Researcher*, 5th edition, (New York: Harcourt Brace Jovanovich, 1992) is packed with useful advice for all researchers, and is particularly valuable for students who plan historical, anthropological, or descriptive dissertations. Doctoral students should internalize the style conventions of a recognized manual of style appropriate to their scholarship such as the *Publication Manual* of the American Psychological Association.

It is wise to choose a sponsor with some forethought about

intellectual styles -- those of the sponsor and those of the candidate. A candidate who wants close oversight should choose a sponsor inclined to give it; one who wants room to work independently for prolonged periods should seek a sponsor comfortable giving infrequent, but demanding feedback. What does a candidate need in order to do his or her best work and what kind of sponsorship will draw that best work from the candidate? Whatever the style, it is the dissertation sponsor's responsibility to work with the candidate – to exhort, criticize, and cajole – until the manuscript is ready for a successful defense. It is the responsibility of committee members to serve as a reality test in that interaction between candidate and sponsor. A dissertation should not come to defense before the sponsor says it is ready and the committee members concur in that judgment. Outside readers have the function, in the defense, of validating or contesting these professional judgments from a disengaged point of view. Problems in defenses usually arise when a candidate becomes impatient and presses directly to get done by this or that self-imposed deadline and the defense proves premature. If the candidate has done a good job and the sponsor and committee members have taken appropriate care, the actual defense should be a challenging, reflective discussion around the dissertation project and the candidate's accomplishments. Then it is on to the work of the world.

To summarize: to earn the doctorate in COMMUNICATION, COMPUTING, AND TECHNOLOGY IN EDUCATION, a student must submit a program plan and statement of total program and complete at least 90 points of course credit in accordance with these; earn certification by demonstrating the requisite levels of academic achievement in the certification examination and a suitable capacity for professional action through a portfolio review; and then complete a major undertaking in his or her field by proposing, completing, and defending a dissertation or doctoral project.

Special Degree Cohorts:

The Internship-Based Cohort Option:

This track is for students who will work full-time for a Masters degree in one of the programs in COMMUNICATION, COMPUTING, AND TECHNOLOGY IN EDUCATION at Teachers College. The Cohort option is for students particularly interested in integrating advanced technologies into the school curriculum, K-12. Each September, CCTE will admit up to 20 masters candidates who will study full-time as a cohort, completing their degree in one year. Through courses, fieldwork, and internships, participants will study leading efforts to develop the school curriculum through technological innovation. Participants will take a prescribed set of courses and engage in practical design and implementation work to fulfill current Masters degree requirements. They will acquire a theoretical basis for creative work with technology in education through selected courses. They will gain practical experience in the classroom uses of information technology via studio design work and internships at the Dalton School or other innovative schools in New York City. Upon completion, participants in the Internship Cohort should be ready for leadership roles on school faculties in using advanced information technology to transform the teaching and study of core curriculum areas. For information, write Robert McClintock, Box 136, or call (212) 678-334 or 678-3115, or visit www.ilt.columbia.edu/academic/ibco..

The Intensive Masters Program in Computing and Education:

This track was designed primarily for those teachers who live too far from Manhattan to attend courses during the regular academic year. Students in this program attend intensive four-week sessions at Teachers College, usually in July, and do the remainder of their credit work through independent study. The degree can be obtained in two summers and the intervening academic year, but can also be done over a longer period of time. Courses and independent study work focus on all aspects of using computers in teaching and learning, including theories of instructional design, use of software, new technologies such as hypermedia and telecommunications, teaching strategies, and software production. The Intensive Program accepts up to about 20 new students per summer, and over the past ten years more than 150 students have completed the program. Housing is arranged at a Columbia dormitory. For more information, write Howard Budin, Box 8, Teachers College, or call (212) 678-3773, or visit www.tc.columbia.edu/~academic/ctsc/imp.htm.

Ph.D Options:

Ph.D. in Communications

James W. Carey (chair). Professor of Journalism
Vincent Blasi. Corliss Lamont Professor of Civil Liberty
Alan Brinkley. Allan Nevins Professor of History
Michael Delli-Carpini. Associate Professor of Political Science in Barnard College
Herbert Gans. Robert S. Lynd Professor of Sociology
Morris Holbrook. William T. Dillard Professor of Marketing
Peter Johnson. Assistant Professor of Political Science
Ira Katznelson. Ira I. Ruggles Professor of Political Science
Robert O. McClintock. Professor of History and Education in Teachers College
Bridget Nacos. Adjunct Assistant Professor of Political Science
Eli Noam. Professor of Business
Jeffrey K. Olick. Assistant Professor of Sociology
John V. Pavlik. Professor of Journalism
Robert Shapiro. Professor of Political Science
Andie Tucher. Visiting Assistant Professor of Journalism

The Communications Ph.D. Program consolidates, enhances, and focuses the considerable resources of Columbia on a multidisciplinary approach to the study of communications, within the humanities and social sciences, broadly understood, and in relation to the professional schools of Business, Journalism and Law. The growth of the power of media technology and business in the production, distributions, and storage of information, entertainment, and news makes Columbia, with its long tradition of scholarship on the media, and its location in the communications capital of the world, the ideal place for the marriage of research and teaching, theory, and practice in this important area. The interdisciplinary program provides unique opportunity and

preparation to students who wish to conduct original research in communications, to teach in colleges and universities and to pursue research careers in government and industry.

For requirements and application information, see the Graduate School of Arts and Sciences Bulletin or www.columbia.edu/cu/gsas/bulletin/commcata.html.

Ph.D. in Cognitive Studies

John B. Black, Professor of Computing and Education
James E. Corter, Associate Professor of Psychology and Education
Lawrence DeCarlo, Assistant Professor of Psychology and Education
Clea Fernandez, Assistant Professor of Psychology and Education
Herbert P. Ginsburg, Jacob H. Schiff Professor of Psychology and Education
Deanna Kuhn, Professor of Psychology and Education
Dolores Perin, Associate Professor of Psychology and Education
Stephen T. Peverly, Associate Professor of Psychology and Education
Ernst Z. Rothkopf, Cleveland E. Dodge Professor of Telecommunications and Education
Joanna P. Williams, Professor of Psychology and Education

The Program in Cognitive Studies in Education at Teachers College, Columbia University offers graduate studies leading to the M.A., Ed.M., Ed.D., or Ph.D. degree in Educational Psychology. The program (formerly known as "Educational Psychology: Human Cognition and Learning") is part of the Department of Human Development, which also houses programs in Developmental Psychology, in Measurement, Evaluation, and Applied Statistics, and in Sociology in Education. Research and coursework in the Cognitive Studies in Education program integrate perspectives from cognitive psychology, developmental psychology, educational psychology, and computer science to investigate the cognitive mechanisms underlying thinking and learning. The Cognitive Studies in Education program offers training in basic theories of human learning and cognition, experimental research methods, research-based improvements in educational practices, and in the development of innovative educational methods built around new technologies. Careers available to graduates of the program include college teaching and research, research and development in training for commerce and industry, evaluation and curriculum development for school systems, and educational software design. Non-degree registration in most courses is also possible for education and industry professionals.

For requirements and application information, see the Teachers College Bulletin or www.tc.columbia.edu/academic/cognitive/

Orientation and Advisement:

Teachers College holds general orientation sessions at the start of each academic year. In the context of that COMMUNICATION, COMPUTING, AND TECHNOLOGY IN EDUCATION has orientation sessions in which faculty members, instructors, and advanced students will give an overview of what is happening in CCTE, the Center for Technology and School Change, and the Institute for Learning Technologies. These orientation activities are an opportunity for incoming students to get to know each other; to establish computer accounts and to start making use of facilities; and to plan a fruitful program of study; and to learn about internship and fieldwork opportunities.

All faculty members can serve as **advisors** and sign forms for special permissions and applications that students must file. In addition instructors and staff and other students can be important sources of insight and advice on procedures and courses. Students select an advisor by going to one or another faculty member regularly for advice and counsel about their work. The advisor-advisee relationship is a largely functional one, serving to help students meet the formalities of their degree programs, although often the best advice will come from a faculty member whose interests are close to those of the student receiving advice. Doctoral students need additionally to select a **dissertation sponsor**, a faculty member who can provide assistance and supervision in the student's effort to develop, research, and write a dissertation. The sponsor-candidate relationship is largely an intellectual and professional one, depending on sustained common academic interests.

Teachers College has adopted a successful system of telephone registration. This innovation is forcing a significant transformation of advisement procedures. Until recently, advisement took place primarily during the registration period at the beginning of each term. Then, students had to see an advisor in order to get their course registration cards signed. The need for such signatures has largely disappeared and with it the likelihood that students will not consult an advisor in planning their course programs has significantly increased. To counter these tendencies, CCTE is establishing alternative advisement procedures by instituting an Advisement Week late in each semester. During it, each M.A. and M.Ed. candidate will be required to go over his or her program with an advisor and each Ed.D. student will be required to review progress towards the degree with a faculty committee. These meetings should be a time when students can assess their progress towards their degree and difficulties and opportunities that advisors may perceive can be discussed. Everyone's time is constrained and we can make the most of it by setting time aside to attend to advisement with efficient care.

Internships and Fieldwork

Students in COMMUNICATION, COMPUTING, AND TECHNOLOGY IN EDUCATION should consider making internships and fieldwork important parts of their academic programs. The interaction of information and communications technologies with education is a practical, field-based interaction, whether it involves implementing new media in old classrooms or working under real-world deadlines on educational software and curricular innovations. New York City is one of the world foci for new media development and Columbia University has direct links to the companies, large and small, working in the field. Some software development groups are now funding internships for work on their projects at a distance. The Institute for Learning Technologies and the Center for Technology and School Change have a full program of internships associated with projects in collaborating schools and institutions of higher education. In addition, through these and other projects, there are fieldwork opportunities in software development projects.

In general, students can earn academic credit through internships or fieldword, with a 10-hour internship week translating to a 3 points of academic credit through MSTU4900, MSTU5200, MSTU6200, or MSTU6400. The Institute for Learning Technologies sponsors a colloquium for all engaged in internships and fieldwork that meets every other week to discuss selected readings and their relevance to the principles and purposes informing their practical work. Students engaged in these experiences should each submit a reflective essay relating their practical work to their academic studies in the area of educational informatics. In addition to academic credit, internships and fieldwork sometimes bear remuneration, usually starting at $10 an hour and going up $15. The primary reason for engaging in these activities, however, should be academic. The following are major areas for internships and fieldwork through the Institute for Learning Technologies and the Center for Technology and School Change.

School-Based Professional Development. Assist K-12 teachers in integrating technology in the classroom. Help introduce the latest new media technologies to schools and help teachers and students use them collaboratively in interdisciplinary projects. We are seeking people who have an understanding of Windows '95 and Macintosh operating systems, as well as a number of different web-related applications.

Curriculum Development: Language Arts, Humanities, Social Studies, Math-Science-Technology. Work with educators, scholars, and cultural institutions to collaboratively develop curricular strategies, tools, and content for one of ILT's ongoing web-based curriculum projects. These projects are all attempting to advance the use of web-based materials in the classroom and to develop links between higher education and the public schools.

Evaluation. Work on formal evaluations of innovative new media educational projects for diverse schools and departments at Columbia University, for K-12 schools in New York City and around the country, and for commercial software development companies. ILT interns work on these projects, contributing to all aspects of the evaluation effort, including instrumentation, data collection, data analysis, and report write-up.

Technology/Infrastructure. Interns interested in technology deployment and/or infrastructure development assist in bringing communications systems into K-12 classrooms and facilitate the integration of such systems into the curriculum. Those interested should have a basic familiarity with personal computers and a desire to learn data networking.

Software Development. Software development interns work closely with full-time research staff in creating stand-alone and networked applications that bring technology to bear in developing effective and compelling instruction. Interns have access to the resources of ILT, CTSC, and CCTE -- their array of high-performance workstations, their libraries of authoring software, as well as to image and video capture suites.

CCT/ILT Design Studio & Intern Seminar

As part of the aim to anchor the study of educational informatics in reflective practice, ILT and CCTE sponsor a **Design Studio**, which provides students with access to an advanced development environment, technical and design assistance in the creation of Web-based educational resources, and a community of support and criticism.

The Design Studio has three presences -- a physical place and resources, people who can shape and lead it, and a presence in cyberspace where participants can develop and show their work. Physically, the Design Studio is the user area in 332 Horace Mann. Jennifer Hogan, who has designed and developed the *Digital Dante* project for ILT, will direct the Design Studio. Virtually, it resides at **www.ilt.columbia.edu/design**.

All CCTE majors and non-majors registered in CCTE courses will receive user accounts in the ILT domain. At the start of each term the ILT technical group will generate the accounts automatically, creating User Names from the first four letters of each student's last name and the last four digits of the student's ID number. The initial password will be the student's ID number, which the student should change on activating the account. These accounts will automatically expire 30 days after the start of the ensuing term, unless the student continues through CCTE or one of its courses for the ensuing term.

By logging in to their account in the ILT domain, students will have server storage and working access to a full range of design and development tools. Storage will be unlimited, but should a student need more than 100 megabytes, short or long term, he or she should notify the account manager, **accounts@ilt.columbia.edu**.

Research and Development Resources relevant to CCTE

Teachers College, and Columbia University as a whole, have extensive research and development resources supporting work in CCTE. Activity concentrates on four large concerns about the interaction of information and communications technologies and education: the advancement of knowledge, curriculum innovation at all levels of education, professional development, and the adaptation of educational institutions to conditions enabled by new media.

Institute for Learning Technologies (ILT). The Institute works to advance the role of computers and other information technologies in education and society. Through its program of practice, ILT seeks to empower the creative reform of education through three types of work with technology:

- implementing, according to constructivist principles, real-world projects using multimedia and network technologies to create sophisticated learning environments;
- sponsoring exploratory development and participatory design efforts to discover the academic potentials of emerging technologies; and
- sustaining public policy initiatives that mobilize broad coalitions of interested parties from academe, government and industry in order to transform education.

ILT is engaged in a number of large scale research projects intended to develop, test and implement effective pedagogical approaches to the use of new information and communications technologies in education. Its subject areas address K-12 and undergraduate education in math, science, and engineering, the social sciences, the arts and humanities, and graduate level professional studies in a variety of fields. The Institute's scope of new media development efforts includes curriculum development, design and evaluation, faculty and teacher development, and dissemination.
Robert McClintock & Frank Moretti, Co-Directors,
www.ilt.columbia.edu.

Columbia Center for New Media Teaching and Learning (CCNMTL). In partnership with the faculty as content experts, the Center is committed to advancing the purposeful use of new media and digital technologies in the educational programs of Columbia University. We are committed to ongoing evaluation of the efficacy of our work within the University.

Basic Strategy I: Creating the Culture of Use

The Center is committed to extending the population of involved faculty by providing them with a broad range of points of access: workshops, forums, individual consultations, as well as ongoing and sustaining support in the development of projects. We will begin with anyone who is willing to bring us a syllabus. In developing more advanced projects, we are committed to building "visible heuristics," that is, projects in collaboration with faculty that act as demonstrations and explorations of pedagogical and curricular possibility.

Basic Strategy II: Empowering Students and Faculty with New Generic Tools

We are committed to building what we call the Columbia Educational Operating System, a suite of integrated applications that extends the capacity of students and faculty to capture, analyze, and integrate data in new ways. CEOS will also provide equally powerful communications tools to facilitate dialogue and the exchange of ideas.

Basic Strategy III: Forging Partnerships

The Center is about building partnerships and providing the motivation and venue for the integration of disparate efforts in digital development. In this capacity, the Center is presently working with not only individual faculty members but also other entities of the University committed to similar goals, such as CIESIN, CERC, ACIS, CME and others. The Center is also active in contributing to the strategic planning on the school, college and university level.

Working in partnership with faculty, we create flexibly adaptive tools that teachers can shape to fit their particular classroom context. Each of our projects has focused on overlapping areas of innovation to support student inquiry and improve students' understanding. Our projects include visualization and modeling tools; real-time data collection; data sharing programs; internet-based annotation and study tools; subject specific online audio, video, text, and graphic reserves; music and language training environments; archival data bases; interactive simulations and multimedia study environments.

Frank Moretti, Executive Director
www.ccnmtl.columbia.edu

Center for Technology and School Change (CTSC). The Center for Technology and School Change at Teachers College is committed to working with educators to effect meaningful and long-lasting integration of technology into the life of schools. Center projects include: helping schools plan for technology integration; teaching educators about technology and its relationship to curriculum; studying the effects of new technologies on school life and learning; creating new programs and opportunities for learning about technology; developing new technology products for education; and collaborating with others in industry and education to further our goals.
Howard Budin and Ellen Meier, Co-Directors.
www.tc.columbia.edu/academic/ctsc/

Other Institutes and Centers working with New Media at Columbia University

Columbia Institute for Tele-Information (CITI). The Columbia Institute for Tele-Information (CITI) is a university-based research center focusing on strategy, management, and policy issues in telecommunications, computing, and electronic mass media. It is a Sloan Foundation industry research center.

Founded in 1983 at Columbia University, the institute is the first research center for communications economics established at a US management school. Its location in New York City provides a unique foundation for these activities. Research collaboration among academic, corporate, and public sectors is vital in analyzing the complex problems associated with managing communications enterprises,

systems, and policy in environments of rapidly changing technology and regulation.

In April 2000, the Alfred P. Sloan Foundation selected the institute as its fifteenth academic center for industry research and the only one for the field of telecommunications. This enables CITI to substantially expand its program of research on the telecommunications sector.
Eli Noam, Director.
www.citi.columbia.edu/

Center for New Media, Columbia School of Journalism (CNMJ). The Center for New Media is advancing the art of telling stories: their content, context, design and delivery with a mission to define content, ethics and professional standards for new media.
John Pavlik, Executive Director.
www.cnm.columbia.edu/

Center for Research on Information Access (CRIA). The Center is a linking organization between research, applied research, and applications concerning the Library of the future, whose goal is to integrate and coordinate the various digital library related activities at Columbia University.
Judith Klavans, Director.
www.cs.columbia.edu/~klavans/cria.html

Media Center for Art History (MCAH). Operating under the Office of the Vice Provost in partnership with the Department of Art History and Archaeology, the Media Center for Art History has a national mandate to consider the application of imaging and information technologies for research, teaching, and publishing in art history - and particularly the innovative analysis of architecture and the constructed environment.
Stephan Murray, Director. delorme.mca.columbia.edu/

Center for Environmental Research and Conservation (CERC). CERC's goal is to create long-term solutions to combat the loss of biological diversity and natural resource depletion, while meeting the needs of a growing worldwide human population.
Don Melnick, Director. hwww.columbia.edu/cu/cerc/

Black Rock Forest Consortium (BRFC)
The Black Rock Forest is a 3750 acre (1500ha) natural area located in the Hudson Highlands on the west bank of the Hudson River, 50 miles (80km) north of New York City. The Consortium provides a center for research and teaching at all levels and an information network linking students, researchers, teachers, administrators, and institutions.
William Schuster, Executive Director.
www.blackrockforest.org/

School of the Arts Digital Media Center (ADMC). The Digital Media Center is the instrument with which our students have begun to re-imagine art's relationship to our culture, and its future. The Center itself is an affirmation of Columbia's dedication to providing a creative and intellectual center for artistic achievement using leading edge digital technologies. As our society moves further into the information age, decisions will have to be made as to what traditions will be carried forward, and how we will integrate them with emerging tendencies as we invent the forward edge of this new culture. A major share of those decisions will be made in our universities, and at Columbia within facilities like The Digital Media Center. With the Center at their disposal, the students and faculty within the School of the Arts are uniquely poised to play an essential role in giving our future its artistic form. http://www.columbia.edu/cu/arts/dmc/

Columbia Earth Institute (EI). The Columbia Earth Institute brings together researchers and educators in the Physical, Biological and Human Sciences to create new knowledge, educate the leadership and public, and develop innovations that will lead to wise stewardship of our planet.
Peter Eisenberger, Director.
www.earthinstitute.columbia.edu/

The Botwinick Gateway Lab. The Gateway Lab, a state-of-the art multimedia facility in the School of Engineering and Applied Science, is a major tool in SEAS' education reform efforts and focuses on incorporating multimedia technology into the engineering curriculum.
Morton Friedman, Director.
www.seas.columbia.edu/gateway/

Columbia Strategic Initiatives Projects. For more complete information on new media projects at Columbia, consult the web resources on Columbia's Strategic Initiative Program run by the Michael Crow, Executive Vice Provost.
www.columbia.edu/cu/research/

COMMUNICATION, COMPUTING, AND TECHNOLOGY IN EDUCATION COURSES

A listing of courses scheduled to be offered in COMMUNICATION, COMPUTING, AND TECHNOLOGY IN EDUCATION during the 2000-2001 academic year follows. Most courses are offered once a year; a few are offered once every two years. Current scheduling information may be obtained from the program office.

MSTU4000. **Core seminar in communication, computing and technology** (1-2)
Professor McClintock and Faculty. Required for incoming students. Meets with MSTU6600. Discussion of critical issues, reading of key works, development of project ideas, presentation of work in progress, conversations with leaders in the field. Special fee: $25.

MSTU4008. **Information technology and education** (3)
Professor Rothkopf. Analytic overview of the uses of information technology in instruction. Examination of psychological and practical impact of information technology on our culture and its educational institutions. Special fee: $25.

MSTU4010. **Theories of communication** (2-3)
Professor Moretti. A broad, multidisciplinary survey of contemporary perspectives on communication. Topics include: definitions, models and theories of information processing, history of media change, cross-cultural communication, interpersonal communication, and the uses and effects of mass media. Special fee: $35.

MSTU4012. **Film as art: Introductory** (2-3)
Professor Akrami. Film as 20th century art, emphasizing form and style. Analysis of feature-length and short films of different nations, styles, themes, and genres. No previous experience in film analysis needed. Special fee: $50.

MSTU4016. **The history of communication** (3)
Professor Moretti. A comprehensive survey of the history of communication, tracing the development of the dominant modes of transmitting knowledge, from speaking to writing, from printing to the electronic media. Special fee: $50.

MSTU4018. **Design and communication in modern culture** (3)
Professor McClintock. How have practices of abstract reasoning, the pursuit of formalism, and conceptualizing the structure of complex phenomena affected modern design and communication? Readings and class discussions explore this question, using examples drawn from architecture, fine art, graphics, typography, photography, advertising, industrial design, formal organization, process control, transportation, information theory and management, and major media of communication. Special fee: $25.

MSTU4022. **Telecommunications, distance learning, and collaborative interchange** (3)
Professor Taylor. Introduction to the use and educational implications of telecommunications, distance learning, and collaborative interchange using telecommunications, particularly the Internet and the World Wide Web. Special fee: $25.

MSTU4023. **Cinema as cross-cultural communication** (3)
Professor Akrami. Analyzes how films explore culture. Discussion the film as well as on the cultural messages portrayed. Special fee: $50.

MSTU4024. **Television and the development of youth** (3)
Ms. Kaplan. A comprehensive survey of the socializing and educational effects of television viewing during childhood and adolescence. Within a developmental framework, emphasis is placed on reviewing and critiquing research involving the effects of both formal features of television (e.g., cuts, pans, pace) and the various types of television programs on viewers' comprehension, behavior, attitudes, and beliefs. Special fee: $50.

MSTU4030. **Computer applications in education** (3)
Mr. Schultheiss & Ms. Kieran-Greenbush. Hands-on experience learning a variety of computer applications, focusing primarily on word processors, spreadsheets, and database managing. Students create their own educational applications. No computer background assumed. Special fee: $50.

MSTU4031. **Programming I** (4)
Mr. Schultheiss. Communicating with computers and humans through programs. Uses a graphic language to formalize the concepts behind software structure, and a current, widely-used implementation language such as *Java* to construct representative applications. Special fee: $50.

MSTU4035. **The computer as an instructional aid** (3)
Professor Budin. A presentation of research and issues surrounding the use of computing in schooling. Cognitive and social effects of computers on students are investigated and strategies are developed for integrating computing into the curriculum. Special fee: $25.

MSTU4036. **Hypermedia and education** (3-4)
Ms. BuShell, Mouza, Shiao, Mr. Bolotin, & Dr. Magni. Introduction to hypermedia products and programming and their role in education. Four-point registration is for hypermedia programming lab. Special fee: $50.

MSTU4037. **Computers and the uses of information in education** (3)
Professor Budin. This course examines how computers can structure and present information, evaluates current educational software that uses information, and considers the design of software for integrating information applications into education. Prerequisite: MSTU4030 or equivalent computer experience.

MSTU4049. **Computers and writing** (2-3)
Professor Kleifgen. An examination of the relationship between computers and the writing process. The course explores the effect of electronic text on traditional notions of text, literacy, and communication. Assumes no computing experience. Lab fee: $25.

MSTU4052. **Computers, problem solving, and cooperative learning** (3)
Professor Budin. Considers how computers may be used to promote cooperative learning in problem solving for students throughout the curriculum, focusing on the use of simulations, databases, programming, and problem solving software. Course content will include active participation in cooperative learning using computers as well as background work in educational theory as it relates to

problem solving and cooperative learning. Special fee: $25.

MSTF4078. **Technology and education in Western history** (3)
Ms. Hogan. An historical inquiry into the educational implications of technological change, particularly as it has affected cultural values and the capacities to organize action and to communicate ideas. Special fee: $30.

MSTU4080. **Television and video applications in education** (3)
Faculty. The role of media literacy is explored as a means to understand our popular culture and foster critical autonomy in young people. Emphasis is placed on critiquing educational television programs and video and using them effectively in the classroom. Special fee: $35.

MSTU4083. **Instructional design of educational technology** (3)
Professor Gifford. The nature of instructional technology, systems approaches to planning, managing, and evaluating instructional processes and materials. Emphasis is on instructional design. Special fee: $50.

MSTU4085. **New technologies for learning** (2-3)
Professor Taylor and visiting experts. A survey of technologies such as multimedia and telecommunications applied to learning and research, with full demonstrations and critical discussion by experts. Includes discussion of implications for educational change. Special fee: $50.

MSTU4086. **Text understanding and design** (3)
Professor Black. Covers ideas about how people understand textual materials and learn from them; then applies these ideas to the design of instructional text. Students design instructional materials for topics of interest to them. Special fee: $25.

MSTU4133–MSTU4134. **Cognition and computers**
Professor Black. Ideas about cognition and knowledge representation and how they relate to the use of computers in instruction. The student selects a subject area, learns to represent knowledge from it so that it can be implemented in a computerized instructional system, and uses the knowledge representation to characterize the cognitive prerequisites and consequences of learning to use computers.
MSTU4133. **Cognition and computers** (3) Special fee: $25.
MSTU4134. **Cognition and computers lab** (1-3)
Permission required. Corequisite: MSTU4133. Special fee: $25.

MSTU4901–MSTU4904. **Research and independent study** (1-6)
Permission required. For Master's students. The participating student will propose a program of independent research or project development to a faculty member. Students in their first term of study are generally not accepted. Conference hours are arranged.

ITSF5003. **Communication and culture** (3)
Professor Varenne. Introduction to major theories of human communication and culture as they relate and build on each other.

MSTU5020. **Computer mediated communication** (3)
Professor McClintock. Analyzes characteristics of such computer-mediated communication systems as networked multimedia, electronic mail, bulletin boards, and computer conferencing, and situates these systems in the context of the emerging national information infrastructure. Students will participate in on-line communication systems. Special fee: $50.

MSTU5030. **Intelligent computer-assisted instruction** (3)
Mr. Cohen. Prerequisite: MSTU4133. Participants study ideas about the representation of knowledge, models of the learner, and teaching strategies that have been developed in artificial intelligence and cognitive psychology, and they develop and test intelligent computer-assisted instruction materials for topics of interest to them. Special fee: $25.

MSTU5031. **Programming II** (3-4)
TBA. Prerequisite: MSTU4031 or a solid basic knowledge of programming. Applies programming to significant problems through team projects using *Java* or *C*$^{++}$ to construct salient applications. Special fee: $50.

MSTU5191–MSTU5192. **Educational video production I and II** (3-4)
Mr. Riccobon. Permission required for MSTU5192. Practical studio and field production experience of educational video programs, with special concern for realizing educational purposes through directing, scripting, staging, camera operation, lighting, and sound design. Special fee: $75.

MSTU5194. **Models of interactive learning** (3-4)
Faculty. This course explores the psychological and educational literature on interactivity and learning. What is the role of interactivity in learning and teaching with new educational technologies? What are the key formats and attributes of interactivity with electronic media? These and other questions are studied by discussing current theory and research and by evaluating state-of-the-art media projects. Special fee: $25.

MSTU5201–MSTU5204. **Fieldwork** (1-6)
Permission required. Opportunity for qualified students, individually or in small groups, to develop and pursue projects in schools, community agencies, business organizations and communication facilities. Students in their first term of study are generally not accepted. Conference hours are arranged.

MSTU5510. **Topical seminar** (3)
Faculty. Permission required. Periodically under this number various faculty and staff members offer courses on important topics in communication, computing, or instructional technology and media which will be announced at least one semester in advance. Topical seminars for 2000-2001 include the following. Section numbers vary from term to term.

MSTU5510:XX. **Topical seminar: Toward a theory of distributed instruction** (3)
Professor Gifford. Can the same theories of instruction that inform the organization and conduct of the teaching and learning enterprise within conventional classroom settings also be utilized to guide the design, development and continuous improvement of location-independent computer-mediated instructional settings? We think not. If this is the case, then what new varieties of teaching methods and learning activities must these new theories of distributed instruction accommodate? Moreover, how important is computer-mediated collaborative learning and teaching in these new theories? The purpose of this yearlong seminar is to provide graduate students with a serious interest in learning, teaching and technology a forum for examining these similar questions. Special fee: $25.

MSTU5510:XX. **Topical seminar: Database-driven web site development** (3)
Mr. Matsuoka. A laboratory course in developing educationally oriented database driven web sites. HTML forms, ColdFusion, SQL programming and building databases/data modeling. Course readings and discussions on internet related issues: interface and application design and development. Special fee: $50.

MSTU5510:XX. **Topical seminar: Research methodologies for technology in teaching and learning** (1)
Professor Lowes. Designed for M.A. or Doctoral students in the CCTE department who are developing research proposals that focus on teaching and learning, this one-credit seminar will look at the theoretical bases for different quantitative and qualitative research methodologies (questionnaires and surveys, interviews, ethnographies and case studies, action research), as well as the advantages and disadvantages of each. We will also discuss how to define research problems and develop researchable hypotheses from the existing literature. Each student should come with a research project in mind.

MSTU5510:XX. **Topical seminar: Technology, education, and public policy** (3)
Professor McClintock. A survey of public policy issues influencing the educational uses of information and communications technologies. Issues will include federal policies to link classrooms to the information infrastructure such as the e-rate, the ways research funding affects the educational uses of digital technology, and intellectual property issues with respect to new media in education. Special fee: $25.

MSTU5510:XX. **Topical seminar: Technology and school change** (3)
Professor Budin. This seminar will examine the history of educational expectations for technology and technology's record in changing schools, in the context of theories of institutional change and efforts through the modern school restructuring movement to include technology. The seminar will examine recent documents and reports on using technology to effect change. Part of the seminar's work will involve planning for effective change via new technologies. Special fee: $25.

MSTU5510:XX. **Topical seminar: Media and education** (3)
Professor Budin. This seminar explores a variety of media and their effect on our thinking, our culture and education. If it is true, as Marshall McLuhan and others have described, that the printing press defined the crucial aspects of the modern world, are we now moving away from the linear, standardized, “factory” culture and education into a new paradigm defined by new media? This seminar will address a number of key questions involved in this shift. It will examine ways in which media differ from each other, society’s expectations for new media, and how education has used media or should be using them. Special fee: $25.

MSTU5510:XX. **Topical seminar: Art, music, and technology: Their symbiotic interplay** (3)
Professor Taylor. Students will visit art exhibits, attend live musical performances, and examine selected video and computer artifacts, including web sites, to explore alternately the use of technology by the fine arts and the use of these arts by technology, particularly with respect to the world wide implications of this symbiosis for education. Special fee: $25.

MSTU5510:XX. **Topical seminar: Writing technology** (3)
Professor Taylor. Participants in the course will examine some seminal works about writing, will study some exemplary traditional texts and some hypertexts, and will engage in extensive writing experience for both media. The experience should benefit both those preparing for work in the new media and those who simply need sharper expressive writing skills. Writing in the context of email will also be examined. Special fee: $25.

MSTU5510:XX. **Topical seminar: Social and emotional learning and digital technology** (3)
Professor Stern. This course will explore how to experience and enhance social and emotional learning. Students will create projects that will focus on the approaches of digital technology to the teaching and learning of one or more components of social and emotional intelligence. Special fee: $25.

MSTU5510:XX. **Topical seminar: Gender, communication, and digital technology** (3)
Professor Stern. The focus of this course is to look at the differential impact of digital technology, an ever increasing part of socialization, on gender. Participants will review and examine commonly known linguistic and communication differences and analyze how and if they have been altered through the medium of digital technology. Special fee: $25.

MSTU5555. **Technology and the emergence of a global curriculum** (3)
Professor Taylor. This course deals with the impact of technology on human society over the ages, how technology in particular is shaped by, and in turn shapes, the vision informing a specific culture and its curriculum, and how the global sharing of technology is inexorably contributing to the emergence of a common global curriculum.
Uses its own website, www.tc.columbia.edu/~global.
Special fee: $25.

MSTU5814. **Work conference** (0-2)
Faculty. Permission required. Occasional brief conferences convened by Communication, Computing, and Technology on subjects of special interest.

MSTU6030. **Evaluating technology in education** (3)
Faculty. Limited enrollment. Introduces a range of evaluative instruments and techniques and applies them, through student teams, to a representative instructional software and to technology-based educational innovations. Special fee: $25.

MSTU6031. **Multimedia educational applications in software development** (3-6)
Professor Taylor. Permission required. Team approach to developing computer-based educational software using hypermedia, authoring languages, and programming languages. Some background in instructional design recommended. Special fee: $75.

MSTU6201–MSTU6204. **Advanced fieldwork** (1-6)
Permission required. Extended opportunities for students who have completed MSTU5200.

MSTU6401–MSTU6404. **Internship** (1-6)
Permission required. Prerequisite: basic courses in the student's specialization, evidence of competence in the internship area, and prior arrangement with cooperating institution. Internship in schools, colleges, Teachers College facilities such as the Microcomputer Resource Center, community agencies, business organizations,

communication facilities. Students in their first term of study are generally not accepted.

MSTU6532. **Seminar in cognitive science** (1-3)
Professor Black. Permission required. In-depth discussion and critique of research proposed and conducted by others and by students in the class. Topics vary from term to term. Course is for advanced students who are designing and conducting their own research projects; they may take the course as many times as they like. Special fee: $25.

MSTU6600. **Colloquium in Communication, Computing, and Technology in Education** (0-3)
Professor McClintock and Faculty. Continuous participation required of doctoral students. Discussion of critical issues, reading of key works, formal proposal of dissertation topics, presentation of work in progress, conversations with leaders in the field.

MSTU6901–MSTU6904. **Research and independent study in Communication, Computing, and Technology in Education** (1-6)
Permission required. For doctoral students. The participating student will propose a program of independent research or project development to a faculty member. Students in their first term of study are generally not accepted.

MSTU7501–MSTU7504. **Dissertation seminar** (1)
Faculty. Permission required. Presentation of dissertation proposal for approval by a sponsoring committee. Student arranges one two-hour meeting with his or her sponsoring committee.

MSTU8900. **Dissertation advisement** (0)
Advisement on doctoral dissertations. Fee: to equal 3 points at current tuition rate for each term. See section in catalog on Continuous Registration for Ed.D. degree.

Other Teachers College Courses for Students of CCTE

Students may find these course substantially relevant to their programs in Communication, Computing, and Technology in Education. They may be used to fill College-wide requirements or to be included in program plans as part of a major.

ITSL4011. **Introduction to computers, language, and literacy** (2-3)
Professor Kleifgen. Sociocultural implications of computer use in education; viability of software use in the light of language learning theories; evaluation of electronic materials for use by bilingual, ESL, and native- and foreign-language learners. Material fee: $20.

ITSL4019. **Orality, literacy, and technology** (2-3)
Professor Hill. An examination of literacy as a set of social practices, embodied both in the traditional practice of oral culture and in the rapidly emerging practices of technological culture. Materials fee: $20.

ORLA 4021. **Introduction to management systems** (3)
Professor Petrides. Introduction to management science theory and computer-based methods for planning, resource allocation, information systems design, and data-based-policy and decision analysis, in both public and private organizations. Special fee: $50.

MSTC4025. **Teaching computer mathematics** (3)
Faculty. A review of teaching methods and curricular innovations in computing and computer mathematics.

ITSL4025. **Cross-cultural communication and classroom ecology** (3)
Faculty. Examination of the influence of culture in the design and implementation of school instruction. Identification of salient theoretical issues related to culture and social organization as they relate to the education of ethnolinguistic and minority children. Exploration of the learning/teaching processes within the context of multicultural and bilingual classroom settings from a cultural perspective. Reflection upon the role of the teacher in creating cultural learning environments. Survey of research approaches which serve as tools to examine classroom interaction. Special fee: $15.

A&HG4029. **Introduction to new technologies in music education** (2-3)
Faculty. Understanding the principles of creating and teaching with synthesizers, MIDI, computers, emphasizing the application to music education. Materials fee: $ 50.

HUDK 4035. **Technology and human development** (3)
Professor Black. Examines the use and design of various educational technologies (computer software, multimedia shareware, TV, World Wide Web sites, etc.) from the perspective of basic research and theory in human cognitive and social development. Provides a framework for reasoning about the most developmentally-appropriate uses of technology for people at different ages.

MSTC4037. **Computer graphics** (3)
Faculty. Transformations, scaling, clipping, windowing, and hidden line algorithms. Software development for applications to mathematics and science education.

MSTC4039. **Mathematical foundations of programming** (3)
Faculty. Logic, Boolean algebra, switching circuits, Turing machines and computability.

A&HG 4048. **Creative computing applications in education and the arts** (3)
Professor Abeles. This course will examine strategies for developing creativity and problem-solving behaviors employing arts and other educational software. Pedagogical principles underlying the design of the software and instructional applications will be reviewed. Special fee: $75.

A&HG 4084. **Art and technology** (noncredit or 2-3)
Dr. Greh. Through class production utilizing electronic imagery systems (computer graphics, computer animation, video synthesizing, digital video effects), the student develops the ability to create artistic statements utilizing technological means. Offered summers. Special fee: $25.

A&HF4088. **Popular culture**. (2-3)
Professor Broughton. Critical examination of mass communication as an informal medium of education: film, TV, comic books, music, dance, advertising. "Low" vs. "high" culture and hybrid forms. Enrollees learn to create and promote their own pop-cultural commodity. Special fee: $45.

A&HF4089. **Aesthetics of technology** (2-3)
Professor Broughton. Technology as a cultural form regulating the development of the human self.

Metaphysical, symbolic and fantasy components in computing, space travel, medicine, reproduction, and children's toys. Literary and artistic representations. Special fee: $40.

A&HG 4089. **New media, new forms: Technological trends in art education** (2-3)
Dr. Greh. Examines new technological tools and new media in art education: the impact of technology in the artroom, the changing role of the art educator, and the convergence of visual technologies. (Offered summers) Enrollment limited. Special fee: $25.

ITSL4190. **Communicative practices: Intercultural perspectives** (2-3)
Professor Kleifgen. A topical course exploring language as situated social practice and focusing on communication within and across national boundaries. Domains examined include schooling, work, community, and the public arena. Both spoken and written modes are considered.

ITSL4811-ITSL4813. **Computer based language teaching** (noncredit or 1 each course)
Professor Kleifgen. Theoretical rationale. Examination of lesson design, organization and operation of language instructional courseware for first and second language learners. Assumes no computing experience. Courses meet on weekends.
ITSL4811. **Computers, language and children**
ITSL4812. **Computers for high school and adult language learners**
ITSL4813. **Special topics in computers and language** (used ITSL4813)

MSTC4827. **C++ programming workshop** (3)
Faculty. Types, operators, and expressions in C++. Functions, program structure. Pointers, arrays, classes and objects.

MSTC4828. **C++ programming workshop laboratory** (0)
Faculty.

ITSF5026 [TH5032]. **The family and television** (3)
Professor Leichter. Permission required. An analysis of the impact of television on the family's educative functions, with special attention to the process by which the family mediates television.

MSTC5027. **Numerical methods and computability** (3)
Faculty. Number representation. Uncertainty and error. Numerical solution of algebraic equations and systems. Numerical calculus. Numerical solution of differential equations.

MSTC5028. **Pascal/data structures** (3)
Faculty. Data types and structures, stacks, queues, linked lists, trees, graphs, hashing.

MSTC5029. **Fundamental algorithms** (3)
Faculty. Searching and sorting algorithms. Graph, tree, and network algorithms.

A&HG5029. **Intermediate and advanced applications of new technologies in music education** (noncredit or 2-3)
Faculty. Specific demonstrations with new music technology emphasizing the development of creative strategies for music education at various levels. Special fee: $75. Noncredit fee: TBA.

MSTC5042. **Science, technology, and society** (3)
Professor Barton. The nature and interrelationships of science, technology, and society as represented in policy and curriculum for science education.

A&HG5048. **Integrating the computer into the music curriculum** (2-3)
Faculty. Demonstrating hands-on participation to introduce students on how the use of Apple Personal computers and MIDI equipped keyboards, and other voice generators, can be integrated into the music curriculum.

HBSE 5063. **Technology in the education of people with visual impairments** (2-3)
Dr. Stolarski. Technological aids and devices in the education of people who are blind or visually impaired, with instruction in use of electronic mobility aids, Optacon, low vision aids, electronic Braille, and other auditory and tactual devices. Field trips, demonstrations, and laboratory sessions.

ORLA5544. **Current topics in policy analysis for administrators** (3)
Professor Mann. Collaborative work groups on topics such as media and education, telecommunications, and the role of entertainment industries. Especially appropriate for clinical projects and/or exploration of dissertation topics.

HUDF5621. **Technology and Society** (3)
Professor Cline. In this special topics seminar students will have the opportunity to explore the many and varied dimensions of the impact of changing information

technologies on the major social institutions in contemporary society. The primary emphasis in the seminar will be on educational organizations.

However, students will have the opportunity also to explore the consequences of information technology utilization on teaching and learning

experiences in other areas, such as family, community, economy, religion, politics, and leisure activities.

ITSL6032. **Research issues in computers, language, and literacy** (3)
Professor Kleifgen. Permission required. Research in the use of digital technology for language and literacy development. Techniques of computerized analysis. New research directions. Material fee: $20.00.

TSL 6125. **Research issues in communicative practices** (3)
Professor Kleifgen. Permission required. A critical review of selected research directions and paradigms for the analysis of spoken and written communication.

ITSL 6302. **Research issues in computers and language teaching** (3)
Professor Kleifgen. Permission required. Prerequisite ITSL 4011 or other 2-3 credit course in computing. Research in computer-assisted reading, writing, and language learning. Techniques of computerized text analysis. New research directions. Materials fee: $20.00.

Course Groupings Meeting the Teachers College Out of Department Requirement

All students must meet the Teachers College three-course out-of-department requirement. It is wise for students to reflect on their long-term goals with respect to this requirement and to consider one or another sequence of courses as means for meeting it. Here are a few such sequences.

Students who anticipate applying technologies primarily in school reform and school change efforts:

C&TY4004. **Basic course in school improvement** (3)
Professor Lieberman or Dr. Falk. Major themes include state of the field regarding school change, schools as social organizations, the individual in the organization, theories of change, and implementation strategies and processes.

C&TY5074. **Curriculum and teaching policy** (3)
Professor Sobol or Darling-Hammond. Prerequisite: C&TY4004. Examination of the theoretical and political bases of curriculum and teaching policies and their influences on school organizations and teaching practices. Explores the policy-making process from policy design through implementation.

HUDF4029. **Sociology of schools** (3)
Professor Natriello. An examination of sociological research on the structure and operation of schools. Particular attention to the

processes of socialization, stratification, and legitimation as well as social organization and the sociology of school curriculum.

Students who will concentrate on developing effective learning tools:

HUDK4029. **Theories of human cognition and learning** (3)
Professor Bloom. Theories of cognitive, social, and language development across all age groups. Special fee: $50.

HUDK5023. **Cognitive development** (3)
Professor Ginsburg. Theory and research on the development of cognitive processes across the life span.

HUDK5034. **Theories of human cognition and learning: Research methods and applications** (3)
Professors Rothkopf and Black. Prerequisite: HUDK4029 or equivalent. Introduction to techniques in psychological investigations of learning, language, memory and thought, psychological analysis of instruction and other practical problems.

Students who will specialize on evaluating technology-based educational applications and projects:

HUDM4050. **Introduction to measurement** (2-3)
Professors Sontag and Wolf. General issues of reliability, validity, norms, etc. Techniques of appraising aptitude, achievement, personality; teacher-made tests; standardized tests in selection, pupil classification, guidance.

HUDM5055–HUDM5056. **Evaluation of institutions, programs, and curricula** (3)
Professor Wolf. Permission required. Prerequisites: HUDM4050 and HUDM4122 or equivalent. Combined lecture, discussion, laboratory, and fieldwork course on the problems, issues, and procedures involved in designing and carrying out evaluation studies.

C&TY5055. **Evaluation issues in curriculum and teaching** (3)
Faculty. Permission required. Critiques of selected evaluation studies of curriculum and teaching materials, practices, and programs. Issues include scientific and pragmatic vs. aesthetic and political; quantitative vs. qualitative; and goal-driven vs. goal-free evaluation.

Students who expect to administer technology programs at the local, state, or federal levels:

HUDF4000. **Education and public policy** (3)
Professor Crain. Current issues in American educational policy.

ORLA4040. **Education policy decision making** (3)
Professor Mann. An introduction to policy analysis concepts and techniques in a range of school and non-school settings. Emphasis on technology and learning.

ORLA4042. **The role of the state in education governance, policy and practice** (3)
Professor Sobol. The impact of state authority on local schools and school districts, seen through case studies of contemporary educational issues. Roles, relationships, trends, and the political context of policy making at the state level.

ORLA5541. **Federal politics, federal policies, and administrators** (3)
Faculty. The impact of federal policies on administrators and vice versa. Examines the interaction between the political arena and the policy arena. Attention to a number of topical areas of policy including implementation studies, the problem of innovation, and non-school-based educating institutions.

Doctoral students should take appropriate research methods courses.

Historical/Sociological:

A&HF6041. **Historical method** (3)
Professor Waite. Permission Required. Methods, principles, and problems of historical researdch and interpretation. Designed for students throughout the College undertaking systematic inquiries on historical topics.

HUDF5030. **Sociological theories of education** (3)
Faculty. Permission required. Prerequisite: one sociology of education course or permission of the instructor. An intensive analysis of the major theoretical writings of functionalist, Marxist, Weberian, and feminist scholars.

MSTF6512. **Social theory and structure** (3)
Professor Bond. Investigation of issues and problems in social theory through the analysis of relevant literature in the social sciences.

Cognitive Development:

HUDK4120. **The empirical study of human development** (3)
Professor Kuhn. An introduction to the research methods that have been employed by cognitive and developmental psychologists, as well as an overview of how these

methods have been applied and the kinds of knowledge they have yielded.

HUDK6592. **Advanced research seminar: Learning and instruction** (3)
Professor Rothkopf. Permission required. Limited to doctoral candidates only. Review and discussion of advanced topics in learning, memory, and cognition, and their relationship to educational issues and problems. This course may be repeated.

HUDK6529. **Research practicum in cognitive development** (2-3)
Professor Kuhn. Permission required. HUDK6630. Special topics in cognitive or educational psychology (3) Faculty. Permission required. Topics to be announced.

Survey:

HUDF5020. **Methods of social research: Survey methods** (3)
Professor Crain. Relationship between research problem and study design, choice of population, sampling methods, instrument construction, interviewing, data processing and analysis.

HUDF5021. **Methods of social research: Evaluation methods** (3-6)
Professor Natriello. Prerequisite: HUDF5020 or the equivalent. Designs for evaluating programs in natural settings. Coordination of field and survey methods of monitoring behavior in organizations. Proposal and report writing. Workshop to be arranged.

HUDF5029. **Sociological research methods in educational settings** (3)
Professor Crain. Methods for the analysis of quantitative data and hypothesis testing. Use of SPSS computer program for crosstabulation, correlation and multiple regression.

Field Research and Case Studies:

C&TY5502. **Introduction to qualitative research in curriculum and teaching** (2-3)
Professor Genishi or Siegel. Introductory seminar on methods in qualitative research, with focus on case studies in classrooms and schools.

ORLA5530. **Action research in organizational behavior** (3)

Professor Orr. Techniques and methods of designing and conducting action research on organizational problems. Various methodological and organizational issues are addressed on the use of action research to foster organizational learning and problem solving through systematic inquiry and reflection. Students conduct an action research project.

ORLA5650. **Field and clinical research methods in education** (3)
Professor Orr. Techniques and methods in designing and conducting qualitative and field research. Includes conceptualizing and designing a study and procedures in qualitative interviewing, observations, focus groups, and document analysis. Students conduct a pilot study.

ORLA6518. **Methods of case study and analysis** (3)
Professor Orr. Techniques and methods of preparing and analyzing case studies of organizations and institutions.

Ethnographic:

MSTF5000. **Methods of inquiry: Ethnography and participant observation** (3)
Professor Harrington. The methods of the behavioral and social sciences as they relate to ethnography and participant observation. Emphasis on the role of theory, characteristics and relative efficiencies of various research techniques, and the importance of integrated research design.

MSTF5001. **Ethnography and participant observation: Structural and interpretive analysis** (3)
Professor Varenne. Prerequisite: MSTF5000. Emphasis on modes of analysis of ethnographic observations (variously known as "interpretive analysis," "discourse conversational analysis") which emphasizes careful analytic descriptions of human behavior in a holistic context.

MSTF5002. **Ethnography and participant observation: Comparative and qualitative analysis** (3)
Professor Harrington. Prerequisite: MSTF5000. Issues of comparative and quantitative analysis of data generated by ethnographic/participant observation inquiries.

Courses in Columbia University for Students of CCTE

We list a selection of courses here that are potentially relevant to developing a program of study in Information and Communications Technologies in Education. A large number of useful courses offered through the Computer Science Department are not listed here. Individual students may want to consult the CS listings, although careful attention needs to be paid to the structure of prerequisites controlling admission into its courses.

Engineering E3005x or y **Technology and society** (3)
Professor Unger. This course may be taken as a technical elective by sophomores, juniors and seniors. The environmental and social impact of technology on human affairs. Emphasis on the consequences of alternative technological choices, and on the role of engineers and applied scientists in making such choices. Topics include engineering ethics, technology in human history, a brief survey of ecological principles, energy needs and resources, transportation, war, computers and communications technology as they affect privacy, the role of technology in the democratic process. (Graduate credit must be specially arranged.)

Comp. Sci. W3139x and y **Data structures and algorithms** (4)
x: Professor Allen; y: Professor Aho. Prerequisite: Comp. Sci. W1007. Corequisite: Comp. Sci. W3203. Data types and structures: arrays, stacks, singly and doubly linked lists, queues, trees, sets, and graphs. Programming techniques for processing

such structures: sorting and searching, hashing, garbage collection. Storage management. Rudiments of the analysis of algorithms.

Medical Informatics G4001. **Introduction to medical informatics**. (3)
Professor Jenders. An overview of the field of medical

informatics. Use of computers and information in health care, specific applications and general methods, current issues, capabilities and limitations of medical informatics.

Sociology G4047. **Urban sociology and social policy** (3)
Professor Gans. A combined sociological and policy-oriented analysis of the American city. The major problems of the city, and of its poor and racial minorities. Urban policy, national economic and social policy, the reduction of inequality and the welfare state. Urban problems as national problems.

Film R4054. **Analysis of film language** (3)
Professor Engel. Prerequisite: the permission of the Division. Examines the grammar of cinematic visual narrative. Analogies between cinema and language are analyzed, with special attention to film's distinct relationship to reality. $50 film fee.

Classical Civilization 4120. **Literacy and education in the Greco-Roman world** (3)
Raffaella Cribiore. The importance and limits of literacy, and the characteristics and changes in education in the Greek and Roman world. Based on literary and archaeological sources, the anecdotal tradition, and the school exercises of Graeco-Roman Egypt.

Political Science W4220. **The mass media in American government** (3)
Professor Nacos. The most important aspects of the mass media's roles in the American political process. The focus is on the press itself (its workings, biases, effects, etc.) and on the relationships between the media and the institutions and actors in politics and government.

Political Science W4238. **Public opinion and political behavior** (3)
Professor Shapiro. A survey of the theoretical and empirical literature on public opinion and individual and aggregate-level political behavior. The nature and measurement of political attitudes, the distribution of knowledge and opinions, political sophistication and ideological thinking, partisanship, the mass media and socialization process, participation, national voting and election processes.

Psychology G4275. **Language, communication, and cognition** (3)
Professor Remien & Professor Krauss. Language use in the context of interpersonal communication. Models of speech production and comprehension, deriving communicative intentions from utterances, perspective-taking, discourse and conversation, dialogic approaches, and language and thought.

Comp. Sci W4400x or y **Computers and society** (3)
Professor Unger. Prerequisite: An introductory course in computer programming. The impact of computers on political, social, and economic processes. Evaluation of the positive and negative contributions of computers. Case studies from banking, law, medicine, and television. Privacy and security of data banks. How society can direct the development of computer applications.

Anthropology W4638. **Anthropology of media**. (3)
Professor McLagan. An anthropological approach to the study of media in the contemporary world. The social effect of different media forms such as film, audio, cassettes, and computer-related technologies in various cultural contexts. Analyzes cultural dimensions of media practices such as journalism and television production in complex societies.

Comp. Sci. W4701x and y **Artificial intelligence** (3)
Professor Stolfo. Prerequisite: Comp. Sci. W3139. Designed to give a senior-level student in computer science a broad understanding of the basic techniques in use today for building intelligent computer systems. State-space representations, problem reduction, means-end analysis, and-or graphs. Heuristic searching: depth-first, breadth-first, best-first, hill-climbing, divide and conquer, minimax, alpha-beta. Predicate calculus, resolution theorem proving, Horn clause theorem provers. AI systems and languages: goals and contexts. Issues of knowledge representation. Learning and concept formation. LISP programming. Other topics as time permits.

Comp. Sci. W4705x or y **Natural language processing** (3)
Professor McKeown. Prerequisite: Comp. Sci. W3139. Prior or concurrent exposure to AI and LISP is recommended. An introduction to the artificial intelligence approach to human language processing. Topics such as conceptual representation, story understanding, language generation, question answering, and the relation between computer models and cognitive psychology. Computer exercises in several of the areas.

Comp. Sci. W4721x or y **Advanced intelligent systems** (3)
Professor Stolfo. Prerequisite: Comp. Sci. W4701. Focus is on current methods of implementing AI expert systems. Topics covered include the structure of problem-solving engines and knowledge bases for expert performance; problem taxonomies; methods to automate the acquisition of human experiential knowledge; methods to automate the explanation of problem-solving behavior; examples of existing expert systems and their application areas.

Comp. Sci. W4725x or y **Knowledge representation and reasoning** (3)
Professor Dalal. Prerequisite: Comp. Sci. 4701. General aspects of knowledge representation (KR). The two fundamental paradigms (semantic networks and frames) and illustrative systems. A selection of some advanced topics such as: hybrid systems, time, action/plans, defaults, abduction, and case-based reasoning. Throughout the course particular attention will be paid to design tradeoffs between language expressiveness and reasoning complexity, and issues relating to the use of KR systems in larger applications.

Electrical Engineering E4900 **Image technology for new media**. (3) Lab as appropriate: (1.5)
Professor Anastassiou et al. This is a modular cross-disciplinary course, in which most faculty members in the area, including faculty from the School of Journalism, Teachers College, and Business School, teach a class of one to two weeks. The course includes a design laboratory project, to be selected out of a list of several alternative such projects that will be offered to the students, involving hands-on experience with equipment in new media technology. The project will be presented at the end of the class to the faculty members who participated in team-teaching.

Political Science W8216. **Topics in intellectual property rights**. (3)
Professor Edgar & Professor Nelson. Maximum enrollment: 25 - 15 from Law School, 10 from outside of Law School. The economics and law of intellectual property rights. Focus on areas where there presently is strong pressure to clarify or change the law, as in biotechnology and software.

Film R4900. **Narrative spaces: hypertext and hypermedia** (3)
ITBA. Prerequisite: the permission of the instructor and one previous course in theory (literary or film). An advanced theory seminar in which students versed in film and/or literary theory study the new ways in which image, text, and sound are being configured in the emerging electronic media, as well as the impact these new ideas are having on theoretical and critical thinking. Fee: $10.

Computer Science W4999. **Computing and the humanities**. (3)
TBA. Text databases. Language applications such as machine translation, information and retrieval, computational stylistics (determining authorship). Digital library applications, including issues in text acquisition, text markup, networking display, and used interfaces. Educational applications. Legal reasoning, history and applications involving inferencing and databases.

Journalism J6010. **Seminar: Section 3 -- Social impact of mass media** (2)
Professor Carey. Surveys social science and cultural studies approaches to mass media, emphasizing the relation of the press to the theory and practice of democracy. Attention focuses on transformations in politics and the press resulting from, among other things, changes in communications technology. Addresses the ruling conceptions concerning journalism and the mass media, how these conceptions are realized in given practices and technologies, and how those ideas, practices, and technologies affect the way politics and social life are conducted.

Journalism J6010. **Seminar: Section 12 -- Exploring new media** (2)
Professor Pavlik. Provides students with a conceptual map of the new media landscape. Through a series of special guest visits, lectures, and demonstrations, students review both the latest technological trends in new media and the cultural and commercial impact of new media. Students look at new media as a BEAT and develop a sense of the scope, depth, and limits of new coverage of new media technology, as well as the prospects for the future of new media and improving its news coverage.

Journalism J6011. **Media Workshop: Section 12 -- New media** (6)
Mr. Lih & Professor Sreevinasan. Students work in teams to publish (on the World Wide Web) stories they report, write, and format. At its core, new media is about in-depth, in-context reporting. Students produce at least three stories or segments of the same story during the term (i.e., every five weeks, not only at the end of the term). However, great stories from any subject are welcomes and encouraged. Enrollment limited to approximately 20 students.

Economics-Political Science G6226. **Science, technology, and economic growth**. (3)
Professor Nelson. Technological advance, how it occurs and the key processes and institutions involved, and its economic effects. The relationships between science and technology, and how both of these activities are related to the way industry is organized and to public programs and institutions (like universities). Technical advance as source of economic growth in advanced industrial countries. Command of technology as a factor behind international differences in living standards and patterns of comparative advantage in trade. Experience of some of the more successful NICs examined.

Law L6341. **Copyright law** (3)
Professor Ginsburg. A general course in copyright law, covering subjects such as: bases for the protection of works of authorship; criteria of protection; ownership and transfer of copyright interests; infringement and fair use; relationship of copyright to state doctrines of privacy, publicity, unfair competition and misappropriation.

International Affairs U6350. **Global communications in world affairs** (3)
Professor Mehan. Traces the increasing importance of communications in world affairs. Topics include various conflicting philosophies, including free flow vs. national sovereignty and private enterprise vs. state operation, as well as the repercussions of new communications technologies.

Music G6610-G6611. **Computer music**. (3)
Professor Garton. Prerequisite: Music G6601-G6602 and the instructor's permission. Knowledge of conventional and electronic music of the 20th century is assumed. Synthesis of electronic music by digital computer. Students gain familiarity with FORTRAN, elementary psychoacoustics, basic programming techniques, theories behind digital sound synthesis, and a computer program used in the digital simulation of waveforms. The two terms are treated as a sequence, with the goal of realizing original music by the end of the second term.

Law L6700 **Telecommunications law** (2)
Professor Liebman and Mr. Cappuccio. The course will consider the legal structure for all information-delivery technologies: wireline and wireless telephone, cable, broadcast, and satellite services. It will consider the legal issues raised by government's attempt to regulate those technologies, particularly as they are now converging.

Business B6833. **Computers and information systems management** (3)
Professor Gopal. Focus is on the key decisions managers make pertaining to computers and information systems. These relate to computer hardware and software selection, computer networks, industry and international standards and the management of information system organization. Major industry trends and vendor strategies are analyzed to understand likely developments. Topics include an introduction to hardware and programming, the selection of computer systems, networking and distributed systems, system implementation met hods, database systems and social and strategic implications of information systems. Case studies, hands-on assignments in operating systems, host connection, database management and spreadsheet and computer-based projects.

Business B8201. **Management of Information, Communications, and Media Resources** (3)
Professor Noam. This is the introductory course for the concentration in management of information, communications and media; it is also appropriate for other students interested in TV, film, computers and telecommunications. A business school approach to the management of information resources as a critical skill, media as major distribution channels and far-flung networks as a means of global control, coordination and rapid transactions. An interdisciplinary approach to media economics, technology and regulation; audience research and program planning; intelligent production, office

automation and the changing workplace; global communications networks and international media flows; electronic banking and financial transactions; and the strategic use of media and information.

Political Science W8216. **Topics in intellectual property rights** (3)
Professor Edgar and Professor Nelson. The economics and law of intellectual property rights. Focus on areas where there presently is strong pressure to clarify or change the law, as in biotechnology and software.

Public Affairs U8400. **Science and technology policy** (3)
Professor Crow. An overview of the science and technology policy environment in the U.S., and examination of key issues and sub-governmental systems. Policy will be reviewed in the context of a global economy and the competing system for innovation around the globe.

Public Health P8735. **Media interventions for public health: social marketing & media advocacy** (3)
Professor Litwak and Staff. Variable roles of social marketing and media advocacy in the design and implementation of health promotion and disease prevention initiatives. Social marketing approaches utilized to influence individual attitudes and behaviors. Audience targeting, cultural issues in message design, choice of communications interventions, formative research and evaluation, and theoretical foundations.

B8827 **Technology management** (3)
Professor Fraiman. The focus of this course is strategic deployment and management of innovation and technology for competitive advantage. This theme is examined through an integrative framework pulling together various functional perspectives of operations, marketing, finance, research and development, design and engineering. The course specifically addresses the technology-strategy connection in light of technological change and its management. Developing, selecting, implementing, transferring and managing product and process innovations are also emphasized. Specific issues of making process technology choices, economic justification and organizational infrastructure are addressed. Additionally, quality management, performance evaluation, productivity management and human resource management, as aspects of operations, are studied in light of advanced manufacturing technologies and automation.

History G8960. **Colloquium on technology and history**. (4)
Professor Bulliet. Exploration of the role of technology in history and approaches toward studying that role. Ancient, medieval, and modern technology, both Western and non-Western.

Journalism J9041-9042. **Problems of communication research**. (3 or 6)
Professor Carey. Open to advanced students by permission of the instructor. Independent reading and research, under the guidance of one or more senior faculty members, leading to the preparation of a substantial research paper.

Film-Law W9095. **Seminar in law and the film industry** (2)
Mr. Horowitz. Examines the economic, cultural, regulatory, contractual, and public policy aspects of the interrelations among filmmaking, production, and exhibition. The dynamics of various sectors of the film business; the creative process, packaging, financing, production, and distribution, as well as the roles of television, home video, pay-TV, motion picture theatres, cable, and satellites. Current clashes and recent regulatory and other developments affecting the film industry.

Finance and Economics B9201-27 **Information technology and the dynamics of economic organization** (3)
Professor Huber & Professor Korn. This course examines the effects of telecommunications technologies on the structure and behavior of the business firm. Through readings in business history, economic theories of the firm, contemporary analyses and practical case studies of the particular challenges and opportunities facing today's business managers, students will explore the ways in which information technology is altering relationships among the internal components of a firm, as well as, more generally, between a firm and its competitors, between users and providers, and between business and government.

LawPolitical Science W9210. **Biotechnology: public policy and legal issues in an emerging industry**. (3)
Professor Nelson & Professor Edgar. The new biotechnology industry raises a variety of public policy and legal issues. How to define what can be patented? What environmental threats are posed and how to deal with these? How much and what kind of public research and development support is warranted?

Sociology G9240. **Workshop on mass media and popular culture research** (3)
Professor Gans. Prerequisites: one year of graduate school coursework. A workshop for conducting individual research and writing projects on the mass media or popular culture. Class discussions will emphasize work-in-progress of workshop members.

International Business B9501:27 **International business communications networks and electronic media** (3)
Professor Noam & Professor Sekulow. This seminar focuses upon the strategic use of communications and new media technologies in international business. It explores the rapid growth of communications markets and trade in information services, and issues arising from these developments within the global media environment. It looks at the ways of conducting business on a worldwide scale through communications systems. The various distribution media which comprise business and data communications networks are examined. These include telephone, data and video transmission networks, broadcasting, cable television and satellite systems, and emergent mobile and microcellular technologies.

Management of Organizations B9701-59 **Entrepreneurship in telecommunications and media** (3)
Professor McNight. This course examines the process and hazards of creating entrepreneurial ventures in the telecommunications and electronic media fields. It begins with the personal makeup of successful entrepreneurs. It then proceeds to how one thinks like an entrepreneur and spots locations where such thinking could find opportunities for high potential value enterprises. Next it examines the steps involved in scripting the venture--creating the business plan. Finally, it offers some practical insight into some basic do s and don'ts of establishing new ventures in this exciting field. Students will emerge from the course with an understanding of what it would be like to create and run a start-up venture. Areas of special attention include the Internet, wireless telephony , submarine cables, entrepreneurship overseas and value-added services. It is expected that one or several entrepreneurial ventures will be conceived, groomed and substantially provisioned for launch in this course.

Management of Organizations B9701-61 **Entrepreneurship and technology** (3)
Professor Kaplan. This course provides students with a hands-on opportunity to develop the technical skills and resources to start or manage a technology company. It partners students with outside entrepreneurs who have technology-driven ideas. Students choose from a number of preselected projects through the Columbia Innovation Enterprise, then work as a team to develop a strategy to commercialize the technology. Students may choose to develop their own technology-based idea.

Workshops

A wide variety of workshops are offered through COMMUNICATION, COMPUTING, AND TECHNOLOGY IN EDUCATION in conjunction with the Institute for Learning Technologies and the Center for Technology and School Change. These are primarily a service through TC's Center for Educational Outreach and Innovation to practitioners in the field. Usually workshops can be taken for one point of academic credit and they sometimes can round out one or another aspect of a program leading to a degree. While there is no limit on the amount of credit that can be earned through workshops, students should be sparing in using this option.

MSTU4802. **Using Computers for Problem Solving and Critical Thinking** (0-1)
How can technology best be used to encourage and teach high level thinking? Examine problem solving games, simulations, information software, and tools for data manipulation, multimedia, productivity, and creativity. Explore the issues behind using these in curriculum, and the practicalities of integrating them into classroom life.

MSTU4817. **Technology and School Restructuring** (0-1)
This workshop explores the relationships between the use of technology and the movement to restructure schools. Through discussion and analysis, as well as exploration of software, it seeks to show how technology is essential to successful restructuring, and how the potentials of modern technology in fact match the goals of school restructuring closely.

MSTU4818. **Women and Technology: Problems and Solutions for Schools** (0-1)
This workshop explores the gender issues involved in modern technology and how these are translated into problems and practice in schools. How can we encourage girls to use computers and ensure equity in computer use? Participants will discuss issues, examine software, hear about current projects and work in the field, and plan solutions.

MSTU4830. **Evaluating the Internet as an Educational Resource** (0-1)
An introduction for educators to the Internet, its various services, and developing criteria for evaluating those services. The workshop overviews networks and the Internet, different types of Internet service, types of telecomputing tools, technical requirements for using the Internet, evaluation criteria for Internet resources and services, and educational issues concerning the Internet. No previous experience necessary.

MSTU4831. **Designing Educational Activities Using the Internet** (0-1)
This workshop is for classroom teachers and instructional designers who want to design and develop Internet-specific educational activities. It covers: principles of instructional designing, ways to categorize and label Internet activities, classroom issues for activities utilizing the Internet, teacher and student roles in these activities, and instructional models and telecomputing.
Prerequisite: the kind of experience described in MSTU4831 above.

MSTU4832. **Publishing on the Web as an Educational Activity** (0-1)
This workshop is for educators wishing to learn the basics of Web publishing, how to handle graphics on the Web, how to design good World Wide Web pages, and how to make WWW sites accessible. It also covers recognizing the cognitive issues for learners using the WWW, so that educators will be better able to utilize Web publishing instructionally and administratively.
Prerequisite: the kinds of experience covered in the two workshops described above.

MSTU4833. **Integrating Web Publishing into Classroom Curriculum** (0-1)
This workshop will concentrate on the principles of designing and assessing educational activities which involve Web publishing. It covers: the creation of clear goals and objectives for such activities; modes of assessing them; planning activities using WWW publishing; planning for the roles of students and teachers; and identifying and planning solutions to technology issues. Prerequisite: the kinds of experience covered in the three Internet workshops described above.

MSTU4838. **Computers and Young Children** (0-1)
This workshop explores, through hands-on experience and discussion, a large variety of software developed for children between 3 and 7 years old, including graphics packages, math and language programs, creative writing and prewriting, problem solving software, and more. It examines the place of such software within an early childhood program, at school or home.

MSTU4842. **Models of Cooperative Learning with Computers** (0-1)
Explore different cooperative learning methods, from peer tutoring to group investigation, in a variety of cooperative settings: multimedia production, group consensus simulations, project production, and more. Discuss how to implement these in classrooms from elementary to high school

MSTU4860. **Constructing a Network for your School** (0-1)
This workshop focuses on how to plan a network implementation in your school. Topics include selection

of hardware, stages of implementation specific to particular space and finances, strategy for Internet implementation, and access from external sites. Workshop participants will be taken through a decision making process resulting in a draft set of network specifications. Ongoing communications with the workshop leader will continue on-line through participation in the Institute's CyberSeminar for Network Managers.

MSTU4861. **Using Commercially Available Software for the Enhancement of Curriculum** (0-1)
This workshop directs teachers' attention to those already existing off-the-shelf pieces of software that can used directly within the classroom environment for the enhancement of the student experience. A part of this workshop will involve a thorough survey and description of commercially available CD ROMs that have immediate potential for enhancement of instruction. It will also focus attention and provide practice in the use of this software and try to raise the ability to use it to the level of a general skill. Ongoing communications will continue on-line through participation in the Institute's CyberSeminar for Teachers.

MSTU4862. **Using Generic Applications for Classroom Purposes** (0-1)
This workshop addresses the use of generic information processing applications such as spreadsheets, wordprocessors, image processors, and basic multimedia authoring tools for the classroom. The focus of this workshop is on how to increase student production by integrating into the flow of classroom assignments and student activity specific applications for students to use to manipulate the information of the course for the purposes of analysis and expression. Ongoing communications with the workshop leader will continue on-line through participation in the Institute's CyberSeminar for Teachers.

MSTU 4863. **Using Computers in Humanities/K-5 level I** (0-1)
Workshop helps classroom teachers enhance curriculum units they teach using digital technologies. This could involve using commercial packages, teacher authored curriculum and or Web-based resources. By building relationships among the participants in the workshops will foster exchange of assignments and on-line communication of the results. Communications with the workshop leader will continue on-line through participation in the Institute's CyberSeminar for Teachers.

MSTU4864. **Using Computers in Math & Science/K-5 level I** (0-1)
Workshop helps classroom teachers enhance curriculum units they teach using digital technologies. This could involve using commercial packages, teacher authored curriculum and or Web-based resources. By building relationships among the participants in the workshops will foster exchange of assignments and on-line communication of the results. Communications with the workshop leader will continue on-line through participation in the Institute's CyberSeminar for Teachers.

MSTU4865. **Using Computers in Humanities/6-8 level I** (0-1)
Workshop helps classroom teachers enhance curriculum units they teach using digital technologies. This could involve using commercial packages, teacher authored curriculum and or Web-based resources. By building relationships among the participants in the workshops will foster exchange of assignments and on-line communication of the results. Communications with the workshop leader will continue on-line through participation in the Institute's CyberSeminar for Teachers.

MSTU4866. **Using Computers in Math & Science/6-8 level I** (0-1)
Workshop helps classroom teachers enhance curriculum units they teach using digital technologies. This could involve using commercial packages, teacher authored curriculum and or Web-based resources. By building relationships among the participants in the workshops will foster exchange of assignments and on-line communication of the results. Communications with the workshop leader will continue on-line through participation in the Institute's CyberSeminar for Teachers.

MSTU4867. **Using Computers in Humanities/9-12 level I** (0-1)
Workshop helps classroom teachers enhance curriculum units they teach using digital technologies. This could involve using commercial packages, teacher authored curriculum and or Web-based resources. By building relationships among the participants in the workshops will foster exchange of assignments and on-line communication of the results. Communications with the workshop leader will continue on-line through participation in the Institute's CyberSeminar for Teachers.

MSTU4868. **Using Computers in Math & Science/9-12 level I** (0-1)
Workshop helps classroom teachers enhance curriculum units they teach using digital technologies. This could involve using commercial packages, teacher authored curriculum and or Web-based resources. By building relationships among the participants in the workshops will foster exchange of assignments and on-line communication of the results. Communications with the workshop leader will continue on-line through participation in the Institute's CyberSeminar for Teachers.

MSTU5814. **Work Conference: Creating Student Projects with Technology** (0-1)
This workshop explores how school technology can facilitate and enhance the creation of interdisciplinary classroom projects for a variety of ages. Participants will learn to use multimedia, desktop publishing, video tools, and data management software as part of the process. Participants are encouraged to bring idea for projects, as well as pictures, text, and data to use in them.

MSTU5814. **Work Conference: Integrating Technology into the Elementary Classroom** (0-1)
Most elementary teachers would like to use computers more in their classrooms, in ways that are productive for their students and manageable for themselves. This hands-on workshop explores how to integrate technology into all aspects of the elementary curriculum. We will work with learning objectives, the new national standards, and new technologies to develop plans on a variety of levels: overall approaches to technology integration, interdisciplinary unit plans, and lesson plans that can be implemented immediately.