

# Developing a Curriculum on the Arts and Mechanics of New Media for an International Post Graduate Audience

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The International Certificate Program for New Media (ICPNM) has been developed by Fraunhofer CRCG in cooperation with the Rhode Island School of Design/Continuing Education (RISD/CE) for international, early-to-mid-career professionals in government, business, industry, or education. Students from these fields benefit from a rigorous and comprehensive course of study in a concentrated six-month period with an additional three-month period of exclusive involvement in ongoing projects. Other program partners that provide additional know-how and lecturers are Technische Universität Darmstadt, Germany; the Media Communication Management Institute at the Universität St. Gallen, Switzerland; the Fraunhofer Institute for Computer Graphics, Darmstadt, Germany; Brown University, Providence, Rhode Island, USA; and the Centre for Advanced Media Technology, Singapore.

Accompanied by Web-based course material for distance course preparation and review, the program offers a sequence of learning experiences that encompasses a specific body of knowledge and theory regarding design, use, and applications of new media. This program, however, goes beyond a theoretical exploration of new media issues by grounding the theory in practical applications. Participants spend over half of their time in an ongoing research program under the auspices of CRCG and are assigned sub-tasks based on their interests and the needs of the project. At the same time, they explore design processes with RISD faculty and are immersed in four core topical content areas: 3D modeling, animation, user interface and Web page design and development, and cross-media publishing.

In this paper we present the motivation that led to the development of the curriculum, the resulting program structure, the content and organization of the program, and the outcomes and lessons learned from the first two cycles of the program, which began in October of 1998.

## INTRODUCTION AND MOTIVATION

Digital libraries, e-commerce, and online communities are topics that not only draw much interest from the business world today, but also represent markets with high potential and expectations. New media, which combines many of the activities in these areas, has recently become a common buzzword within the business community.

In the areas of information technology (IT) and especially new media, there is an increasing shortage of qualified personnel. In Europe alone, there is an estimated deficit of 1.3 million qualified workers in the IT sector.<sup>1</sup> In an effort to turn the tide, universities and educational institutions worldwide have begun offering more programs and courses to provide the professionals demanded by the marketplace. While courses in Web design, multimedia design, CD-ROM design, and lately new media design are generally offered at the university level, an increasing number of continuing education courses in these areas are also becoming available to the growing number of young professionals in business who are trying to stay abreast of new technological developments.<sup>2</sup>

Topics being taught include computer graphics fundamentals; Web design and programming with HTML, XML, and Flash; CD-ROM design; image and video processing based on JPEG and MPEG; and computer animation. However, most of these courses are application- and tool-specific, and do not fully address important design issues.

Despite the proliferation of these courses, professionals in the field of new media have yet to agree upon exactly what new media means and what the key aspects of it are, which leads to the question: What comprises a good curriculum for students in this area?

It is difficult to give a good definition of the term “new media.” A working definition given by the Canadian Radio-Television and Telecommunications Commission (CRTC)<sup>3</sup> is as follows:

New media can be described as encompassing, singly or in combination, and whether interactive or not, services and products that make use of video, audio, graphics and alpha-numeric text; and involving, along with other, more traditional means of distribution, digital delivery over networks interconnected on a local or global scale.

New Media projects, however, do not deal only with commercial production and distribution. Of similar importance are profound knowledge and skills in the areas of organization and management, cultural and social structures and processes in the application domains, and interdisciplinary understanding of new media requirements and impacts.<sup>4</sup> New media have a great integrating effect on working processes and structures that traditionally were separated and distinct, thus allowing for an in-depth specialization of personnel and departments. In today's industry, the demand for strictly specialized education and training is regressive. The new media industry increasingly requests well-educated professionals with hybrid educational backgrounds and a broad overview on many aspects of new media. This is especially true in the lower to middle management. Additionally, working in multidisciplinary teams is an absolute requirement in the modern workplace, but it is hardly considered by traditional curricula.<sup>5</sup>

Universities and other traditional educational institutions cannot adapt curricula fast enough to meet this challenge. Traditional curricula are mostly uni-disciplinary with, at most, a few interdisciplinary courses. Historically evolved competence structures within the traditional educational framework hamper the development of multidisciplinary courses and classes, which, in turn, obstruct development of team-oriented learning environments. In addition, the teaching personnel that trained in the “old media ages” are not keeping up with the rapid evolution of new media. Consequently, new media techniques and technologies are rarely employed in today's new media education.

Several attempts to overcome this dilemma have produced either courses that give an overview of new media to an interdisciplinary audience, with titles such as *New Media for Everybody* or *Everybody's New Media*, or in continuing education programs that are strongly focused on select aspects of new media (for example, visual arts, technology, or business).

These attempts do not fulfill industry's demands for qualified new media professionals as described above. A new educational paradigm is required to improve current practices and to prepare students to work in an international, multidisciplinary, and team-oriented context.

### THE NEED FOR A CROSS-DISCIPLINARY EFFORT

In order to meet the requirements of today's new media industry and anticipate those of the future, we identified the following needs for a corresponding post-graduate curriculum:

- Communicate a holistic picture of new media. New media is more than a single discipline; it is a working style, even a lifestyle, that incorporates many different traditional disciplines, is influenced by them, and vice-versa. Key disciplines for new media include the arts (aesthetics, human-centered, and creative aspects), technology (new media hardware, software, networking requirements, and developments), and business (economic impacts of the new media revolution).
- Teaching and learning in a multicultural setting. Due to its unique role in today's industry and society, new media is strongly influenced by the cultural context in which it is employed. Cultural context can be geographic, social, or professional. We incorporated multiculturalism into the ICPNM program by selecting an international student audience with different professional backgrounds and by involving an international and multidisciplinary team of teachers from universities, industry, and training institutions. Furthermore, we taught courses in the facilities of different participating educational institutions that have different teaching cultures.
- Teaching in multimedia settings. New media education is not convincing if the topics are not incorporated and used in the education delivery itself. We therefore employ state-of-the-art multimedia classroom, computer, and tele-conferencing equipment, as well as Web-based course material for preparation and review, to make the course a new media experience.
- Training in multidisciplinary teams. We consider teamwork a key component of new media working environments. Therefore, special emphasis has been placed on developing the corresponding skills of the course participants. Small, continuously changing, multidisciplinary teams are created to fulfill common tasks, while the group as a whole is charged to complete larger projects. By design, these projects cannot be completed by a single participant. Special team-organization seminars designed for this program prepare the participants to work on teams and as teams.

To meet all the requirements described above, the participating educational institutions had to be carefully chosen in order to provide maximum flexibility of curriculum development while maintaining the highest educational quality. In addition, the different key aspects of new media as described above had to be represented, ideally in an educational context. Choosing Fraunhofer CRG as the incubator for cooperation between the Technische Universität Darmstadt, the Rhode Island School of Design, and the Media and Communication Management Institute of Universität St. Gallen, created a collaboration of leading international educational institutions with industrial affiliations in new media technology, the arts, and business. This collaboration is supported by the INI-GraphicsNet, an international network of excellence comprised of institutions for advanced education, training, and research and development in computer graphics technology, systems, and applications, and represented by Fraunhofer CRG.

The initial challenge in developing an integrated curriculum was to find a common understanding and terminology for similar new media components and different approaches; language barriers did not arise because of different nationalities, but rather because of the participants' various professions and working practices. Commonalities had to be carefully scrutinized and differences thoroughly studied before the educational new media topics described below could be identified.

### IDENTIFIED EDUCATIONAL TOPICS

Based in part on the specialties of the participating educational institutions, the overall new media topics were identified: computer graphics, visual arts, multimedia, cross-media publishing, telecommunication, e-commerce, media management, and multimedia marketing. Each of the educational institutions contributes to one or more of these topics. The main media upon which the program focuses are image, audio, video, Web, and CD-ROM. Depending on the program emphasis, these overall topics lead to different courses to be taught. The next step, therefore, was to decide on the emphasis of the pilot program.

### Choosing a Pilot

We strongly believe that the main benefit of new media is the support it provides for communication and interaction between people, collocated or geographically dispersed. The main components of new media communication in this context are, therefore, humans, computers, and networks. Consequently, we decided to choose a pilot program that focuses on supporting interactivity between humans and the computer medium, as well as between humans and humans through computers, networks, and other media. Using "principles of interactivity" as the program's focus allows us to cover such diverse areas as screen and user-interface design, human-computer interaction, telecommunication, virtual reality and e-commerce.

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## Developing the Curriculum

The ICPNM program is split into five modules, each of which last between three and six weeks. Modules consist of a combination of topical courses, workshops, lectures, and seminars. Each module begins with an introductory course on computer applications and is complemented by a larger project that runs throughout the module. Courses last about one week and include approximately 20 contact hours and additional lab times. Technologically oriented courses are taught by Fraunhofer CRCG, and courses with visual arts emphasis are taught by RISD/CE. They are thematically synchronized by the schedule and integrated content-wise by the larger module-spanning projects. In each of the courses, smaller exercises allow for preparative work on the main project.

Workshops are whole courses that put an emphasis on lab practices. Business-related lecture series, which accompany the instructional part of the program, build upon themselves, thus completing the other program modules as a separate track. The program also provides separate one-time guest lectures or colloquia in the form of seminars, on topics such as teamwork or the state-of-the-art of interactive 3D graphics.

A detailed version of the course description can be found in the supplementary materials to this publication on the corresponding SIGGRAPH 2000 CD-ROM.

## LAYING OUT A MAP

In order to structure the curriculum, a mapping had to be found between knowledge and skills to be taught and content areas to be covered. First, content and structure were defined in detail for each course. For each subtopic of a course, knowledge and skill outcomes were listed and rated. Here, knowledge and skill outcomes were structured in the areas of:

- Design principles: color, composition, contrast, and form.
- Interactive principles: time, audio, video, and navigation.
- Technical principles: mathematics, algorithms, and security.
- Conceptual principles: creativity, narrative, and media.
- Behavioral principles: communication, management, and teamwork.
- Computer applications: Photoshop, Director, Maya, etc.

This complete map (see Figure 2) was used to tune the program and course structures by identifying overlapping topics and missing lectures, and by adjusting the course order in the program. This structure was also used to identify lecturers who might fit into the program.

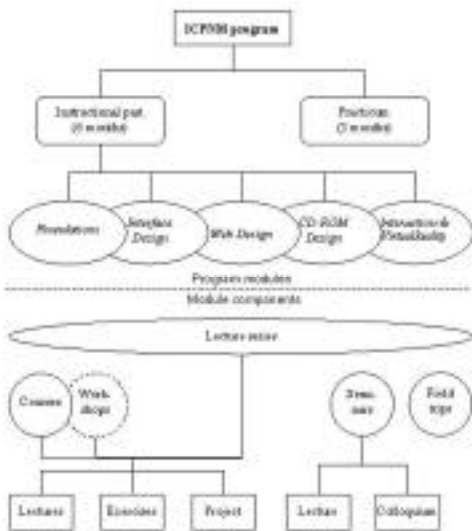


Figure 1: ICPNM program structure overview.

	Visual Principles			Interactive Principles			Technical Principles			
	Color	Form	Typography	Navigation	Time	Audio	Video	Mathematics	Algorithms	Security
Topics	•	•	•	•	•	•	•	•	•	•
Cognition	•	•	•	•	•	•	•	•	•	•
Content	•	•	•	•	•	•	•	•	•	•
Color	•	•	•	•	•	•	•	•	•	•
Typography	•	•	•	•	•	•	•	•	•	•
Form	•	•	•	•	•	•	•	•	•	•
Navigation	•	•	•	•	•	•	•	•	•	•
Time	•	•	•	•	•	•	•	•	•	•
Audio	•	•	•	•	•	•	•	•	•	•
Video	•	•	•	•	•	•	•	•	•	•
Mathematics	•	•	•	•	•	•	•	•	•	•
Algorithms	•	•	•	•	•	•	•	•	•	•
Security	•	•	•	•	•	•	•	•	•	•
Process	•	•	•	•	•	•	•	•	•	•
Structure and Hierarchy	•	•	•	•	•	•	•	•	•	•
Fundamental Language Terms	•	•	•	•	•	•	•	•	•	•
Shapes in 2D/3D	•	•	•	•	•	•	•	•	•	•
Complex Geometries	•	•	•	•	•	•	•	•	•	•
Abstract/Realistic	•	•	•	•	•	•	•	•	•	•
Animation in 2D/3D	•	•	•	•	•	•	•	•	•	•
Interaction in 2D/3D	•	•	•	•	•	•	•	•	•	•
Building the 2D/3D Layout	•	•	•	•	•	•	•	•	•	•
Storyboarding in 2D/3D	•	•	•	•	•	•	•	•	•	•
Storyboarding in 2D/3D	•	•	•	•	•	•	•	•	•	•
Storyboarding in 2D/3D	•	•	•	•	•	•	•	•	•	•
Storyboarding Today's Business	•	•	•	•	•	•	•	•	•	•
Portfolio	•	•	•	•	•	•	•	•	•	•

Figure 2: Section from a table mapping targeted outcomes to program modules and assignments.

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## MAPPING CONTENT AND SKILLS TO ORGANIZATIONAL STRUCTURES

In order to organize and schedule classes and other program modules, the intersection points in the map had to be converted into course modules by combining similar, complementary, and coherent modules from the participating institutions that would cover the corresponding, knowledge, skill, and content requirements. The results led to the curriculum described above. The order of the resulting modules was not only a scheduling issue but also was based on the program structure, described in the following, that aimed for an effective learning experience.

## STRUCTURING THE PROGRAM

The program is built around four essential phases. The first three phases occur for participants in cycles throughout the program. All four phases, however, are also distinctly separate in the structure of the program:

### 1. Acclimation

During this opening phase, program participants receive an orientation in three cultures: the larger American culture, the specific research culture of Fraunhofer CRCG, and the art and design culture at RISD. Participants explore these cultural contexts through activities, orientation sessions, site visits, discussions, and role-playing. During this time, they also examine student/teacher, supervisor/supervisee, coach/mentor, and team member roles. Furthermore, students explore cross-cultural perspectives and familiarize themselves with the specialized languages and processes of art, design, and technology.

### 2. Immersion

During the second phase of the program, participants immerse themselves in their preferred content areas in order to explore the processes of design and the applications of new media. Each student focuses on four content areas and explores their applications through a practicum. Students are expected to divide their time between RISD studios and CRCG labs, where they engage in structured learning activities in topical content areas, such as 3D modeling, animation, user interface development, Web-page design, and cross-media publishing. Fraunhofer CRCG provides open lab hours for practice, project assignments, and practicum work. Students work with RISD faculty on both the design process and the designed product across different media, while CRCG staff and supervisors provide project development and delivery through the practicum experience.

### 3. Reflection

The third phase of the program is a formally structured opportunity for participants to step back, review, and articulate learning activities by applying their new skills. Students are asked to document and present a digital portfolio, which communicates something about their experience and what they have learned. This portfolio could take the form of a Web page, multimedia presentation on a CD, or a more traditional form, such as a published book. During this reflection time, students contemplate and critically assess the processes and product outcomes of their time spent in the program thus far. Their work is reviewed by both RISD faculty members and CRCG professionals, who provide feedback on the presentation's effectiveness as a communication vehicle and its success as a summative and evaluative tool.

### PRACTICUM

In this final phase of the program, students are assigned to ongoing projects at CRCG based on their skills, interests, and the topical content areas upon which they focused during the first three phases of the program. During this three-month period, program participants are assigned subtasks based on their interests and each project's needs. Subtasks can take various forms, such as: integrating a new 3D interaction device for immersion in virtual environments, redesigning an application system's user interface based on user-centered aspects of human-computer interaction, designing and developing a CD-ROM for an industry partner's advertising, or developing and implementing interactive Java applets to enrich Web-based courseware for computer graphics or graphic design education.

Sample project activities, which provide participants with hands-on experience, include tele-collaboration tools for e-commerce, modeling historic buildings for cultural heritage preservation, cross-media information production and delivery, and digital security. By teaming up with CRCG professionals on these projects, students may actively participate in both the communication process and the team learning experience in a supportive, professional environment.

Although the work is supervised, guided, and reviewed by CRCG professionals, the students have the freedom to develop, present, and implement their own ideas, thus emphasizing development of skills in the areas of technology evaluation, integration, and design as a process. To demonstrate their understanding of these processing skills, students are asked to document and present their project tasks, background, solution approach, and results in a report that matches academic requirements.

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Figure 3: New ICPNM Web site designed in a student project [www.icpnm.org/Course98](http://www.icpnm.org/Course98)

## RUNNING THE PILOT

Designed as a pilot program, the 1998 International Certificate Program for New Media (cf. Description in Part One) focused on selected international post-graduate students who benefited from a rigorous and comprehensive course of study in a concentrated six-month period, with an additional three-month period of exclusive involvement in ongoing projects.

The pilot program started on October 5, 1998 and provided education and practical experience to a class of nine selected students from India, Malaysia, Korea, and Germany with a masters or comparable degree in the areas of information technology, architecture, graphic design, or engineering. All students successfully completed this program. After the first five modules, the students had to define and run a project. Examples of such projects are redesign of the ICPNM Web site (see Figure 3), an interactive 3D walkthrough of historic settings in Providence (see Figure 4), and a Flash Animation illustrating the purpose and execution of digital watermarking agents (see Figure 5).

The current course began on October 4, 1999 and consists of 10 participants from Singapore, Germany, the US, and Korea with students who have a BS or comparable or higher degree in the areas of information technology, architecture, graphic design, economics, and philosophy.



Figure 4: A snapshot from the animation 'Virtual South Main Street, Providence, RI'.



Figure 5: Data I/O depiction in the Digital Watermarking Agent Animation.

## EVALUATION AND MODIFICATIONS

A direct demonstration of the success of the program is the fact that during the course of the program all students found jobs in new media, covering the whole area of possible working locations from Internet companies to ad agencies to research institutes.

To gather detailed feedback on the program, we performed an evaluation together with the students. Students were asked to rate the individual courses and to describe their experiences in the program. The primary criticism addressed the initial lack of coordination between assignments within individual courses. Students preferred assignments on individual topics, such as image processing, where the results are consequently reused in subsequent courses and modules, thus giving them a more complete view of the production and management processes. Based on the experiences from the pilot and faculty evaluation meetings during the first run of the program, a modified and more structured assignment schedule was developed for the second run.

## EXPERIENCE AND LESSONS LEARNED

The diversity of the program participants (the different professional backgrounds, credentials, and expectations of students and instructors) made ICPNM a learning experience for everybody, including the organizers. Since the outcomes could hardly be predicted, the course was managed with a great amount of flexibility, allowing for integration of participants' input and propositions. The following lessons learned from the instructors and organizers are exemplary for the dynamics of the program:

- Don't underestimate the students' learning abilities! It was amazing to experience how rapidly students picked up knowledge and skills from areas that were completely outside their own experiences. The main reason for the success was that students were suddenly confronted with information that was complementary to their own experiences, that they "always wanted to know." Furthermore, working in teams with other students gave them additional motivation to demonstrate flexibility.



- Don't underestimate the students' motivation! The number of contact hours required in the program and the complexity of the final projects presented a stamina challenge to the students. Nevertheless, their craving for knowledge never decreased, which challenged the lecturers to continuously add, modify, or deepen presented materials and to introduce additional exercises.
- Don't underestimate the cost of keeping up with the state-of-the-art! In a program that claims to teach state-of-the-art new media skills and applications, the newest of the new is absolutely required. Previous software versions, last year's computer hardware, or traditional classroom equipment were categorically criticized by the students, who tried to "max out" any available application or system.
- Don't underestimate the effort to integrate a multidisciplinary curriculum! In addition to finding a common terminology, as mentioned before, many issues arose during development of the curriculum that one must anticipate to avoid drowning in administrative overload: different educational environments have different processes with different timelines; different business and budgeting models must be coordinated; competencies need to be clarified; guidelines for teaching must be distributed; and a general awareness of the main goals and intentions of the program must be established.
- Don't underestimate the effort to organize an international group of teachers! International experts are not only rarely available for teaching, but their schedules also constantly change. Scheduling these experts early, constantly updating their visit dates, and revising the program schedule around these changes are required to make the program run smoothly. In addition, one cannot expect the different instructors to communicate with each other in order to synchronize similar or complementary courses; instead, this must be done by the coordinators in cooperation with the instructors.
- Don't overestimate the appeal of distance learning! The ICPNM program offered different participation models ranging from remote course participation for the practicum to partial Web-based participation during the first six months of instruction. Although this option reduced the course cost significantly, no participants shortened the nine-month stay in the US in favor of the lower cost or to reduce their time away from the workplace.

## CONCLUSIONS AND FUTURE ACTIVITIES

The first two runs of the ICPNM program were great successes. The program has been extremely well received and our own promotional efforts are increasingly supported by personal recommendations from former participants. International acceptance has stimulated strong interest in the program by other educational institutions that wish to join the program. However, this must be carefully evaluated, since the current program is very successful in its current state, and the organizational effort is already high. On the other hand, we are discussing possible new business models (for example, how to incorporate ICPNM into other university and MBA curricula in the form of intensive study abroad). For this reason, we will continue our efforts to support remote participation in ICPNM, which will strongly depend on development of Web-based approaches for skill-based education. In addition, we are seeking certification of the program by appropriate regulatory authorities.

## ACKNOWLEDGEMENTS

We would like to thank RISD president Roger Mandle and Fraunhofer CRCG president José L. Encarnação, as well as Edmund J. Ferszt, Joe Quakenbusch, Joanna Roux, and Matthias Wloka for their enthusiasm and support in developing the ICPNM program, and all the many lecturers from all over the world for their contributions to the program.

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