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I. Introduction

The microcomputer revolution has generated enormous activity and expenditures by higher education. RIT, like most major institutions, has actively improved the quality and quantity of computer resources on campus (witness the $4.2 million purchase of new Digital Equipment Corporation Vax super minicomputers and GIGI color graphics terminals as well as agreements to sell DEC and IBM personal computers at major discounts to the RIT community). What distinguishes RIT's efforts from those of other institutions has been the emphasis on developing the computing knowledge and skills of faculty, staff and students as a necessary prerequisite for effectively integrating computing into the fabric of the educational environment. A faculty and student body comfortable with and knowledgeable about computer technology is essential as a basis for enabling informed decision making about the instructional use of computers and effective implementation and use in the classroom and laboratory. RIT's computing objectives, adopted by the faculty in the spring of 1982, identify two levels of skill and knowledge for students and faculty alike. First, faculty and students are expected to acquire fundamental knowledge of computers, generally referred to as computer literacy, which serves as a basis for subsequent learning. Second, faculty are encouraged to acquire more significant skills and knowledge about the application of computers within their specific discipline so that they may in turn appropriately incorporate computer technology into their respective curricula.

A major component of RIT's commitment to accomplishing its computing objectives has been the establishment of the Faculty Computer Workshop (FCW), a comprehensive effort designed to provide intensive one and two week workshops for faculty and staff developed and conducted by the Office of Faculty and Program Development. During the past two years over 300 faculty and staff (as well as over 100 participants from local public schools) have participated in these workshops. The effort is ongoing, serving applicants who could not be accommodated during the first two years of workshops as well as providing higher level follow-on workshops for FCW alumni.

II. Background

The initial problem that led to a pilot version of the Faculty Computer Workshop in the summer of 1981 was increasing pressure upon RIT's School of Computer Science and Technology (CS&T) to offer an increasing variety of specialized service courses. CS&T had become one of the largest undergraduate and graduate computer science programs in the U.S. Its burgeoning enrollment made it difficult to meet both its own internal requirements for courses as well as provide service courses requested by other colleges/departments at the Institute. In addition, as the application of computer technology within disciplines became increasingly specialized, it was apparent that it was no more reasonable to expect computer science faculty to teach advanced service courses outside of the mainstream of computer science than it was to expect, for example, economists to teach advanced computer science courses. That a course incorporated computer technology did not mean it was within the domain of computer science. The long term interests of both CS&T and the Institute were best served by helping faculty in other areas acquire the skills and knowledge requisite to teaching computer applications within their own disciplines.

Gordon Goodman, Faculty and Program Development and Wiley McKinzie, Director of CS&T, designed and conducted the first Faculty Computer Workshop, an intensive two week workshop for faculty with little or no previous computer experience. Using a combination of self-paced, individualized instruction, lectures and group activities, the workshop emphasized 1) hands-on experience using and programming computers, 2) computer graphics, 3) microcomputer technology and 4) instructional applications of computers. There were three major objectives. First, it was hoped that faculty anxiety about this technology would be lowered and that they would come to have a more realistic understanding of what
computers could and could not do (specifically in academic and instructional applications). It was not the intention of the workshop to sell this technology. Second, it was hoped that faculty with no previous experience with computers would gain a firm foundation for subsequent use and learning about computers and become better informed consumers of the technology. It was expected that most participants would in time become users of computers learning more about applications in an informal, ongoing process. Third, for a smaller group of participants, it was expected that they would wish to pursue more advanced formal training in computer technology and computer science. Out of this more highly motivated group could come a cadre of faculty who could serve as a source of local expertise within their respective colleges and who could begin to assume instructional responsibilities for advanced courses incorporating current computer practices within their disciplines.

III. The Faculty Computer Workshop

Based upon careful pre- and post-workshop evaluation of attitudes and knowledge, the pilot workshop in the summer of 1981 was a bit rough, but very successful. It anticipated the academic computing objectives that were to be adopted later that academic year by the Institute and offered a tested mechanism for implementing the faculty computer literacy objective. Under the leadership of the Vice President for Academic Affairs, the Office of Faculty and Program Development (then called the Office of Instructional Development) was directed to make the workshop broadly available to the RIT community. The Faculty Computer Workshop was formed and the two week Pascal computer workshops were offered in the summer of 1982 to over 200 RIT faculty, administrators and staff (as well as nine teachers from the Rochester Public School system) selected from a pool of almost 500 applicants.

The workshop format was characterized by intensive (8:30 AM - 4:30 PM, five days a week), self-paced, hands-on use of microcomputers in small and supportive groups facilitated by faculty colleagues with advanced knowledge of computing. Abundant opportunity to work with computers under competent supervision was a hallmark of the experience. A workshop section consisted of fifteen to seventeen participants. There were ten microcomputers for each section and two facilitators, usually computer science faculty, conducting each workshop. Participants rarely had to wait to use a computer or have a question answered, a factor that maximized progress. The computer literacy objectives of the Faculty Computer Workshops closely paralleled those defined for RIT students. Working in cooperation with CS&T, the content of the Pascal Computer Workshop influenced the design of the computer literacy course offered to students to help implement the student compo-

dent of RIT's academic computing objectives. Faculty going through the Pascal Computer Workshop and students taking CS&T's Survey of Computer Science would have a comparable experience, a common body of knowledge and skills on which to build.

IV. The Logo Computer Workshop

Based on the success of the 1982 workshops, and the fact that twice as many people had applied as could be accepted, plans were made to conduct another series of workshops during the summer of 1983. Several factors indicated that a different type of workshop of shorter duration would be a constructive addition to the Faculty Computer Workshop's offerings. A new workshop could help improve the fit between applicant needs and intended workshop outcomes. Another significant factor which made a shorter workshop attractive was more efficient utilization of resources. A second workshop was designed that incorporated the best elements of the Pascal workshops in a smaller package.

Many of the positive features of the two week workshops were carried over into the one week Logo workshop. Improvements, changes and refinements based on evaluation of the 1982 Pascal workshops and assessment of the needs of potential participants were incorporated into the design of the 1983 workshops. A new selection of readings were incorporated into both workshops. Participants were given expanded opportunities to learn about and use software packages. In addition, the workshops used a new computer, the Apple Ile, which provided an 80 column screen with upper and lower case letters as well as an improved keyboard layout. The new computer proved to be quite a bit easier for participants to use.

A major goal of the workshop experience was to introduce participants to methodologies for solving problems with computers. The primary method for accomplishing this goal was programming. It was not the intention of the workshop to turn out proficient programmers nor are we of the opinion that programming is in and of itself a significant component of computer literacy. However, programming is an excellent vehicle, when an appropriate language and programming environment are available, for teaching top-down solution of complex problems. It also can illustrate the use of a computer for active, participatory learning experiences as well as providing greater insight into the fundamental nature of a computer.

Having only one week to address these concerns and not wanting programming to crowd out other important activities, we needed a programming language that enabled people to solve problems of adequate complexity for the methodologies we were teaching to have demonstrable utility. The overhead of learning Pascal, such as learning to use a complex editor, compiler and operating system, made it unworkable but it was important to retain the ability to decompose large
problems into smaller problems that were translatable into discrete procedures. The Pascal workshops had also made significant use of "turtle" graphics which had provided a mechanism for presenting problems of significant complexity that were understandable to a diverse audience. Graphical problems had also proven to be highly motivational.

Our constraints, both self-imposed and external, in the choice of a programming language for the new workshop were 1) a language well-suited to top-down design, 2) a programming environment that was very simple to learn, 3) a language which did not have cumbersome and rigid syntax, 4) a language that provided intuitively graspable but reasonably powerful graphics primitives, 5) a language popular in educational circles and 6) one that would run on the target machine, the Apple IIe. Logo fulfilled all of these criteria quite well. Our previous experiences with Logo indicated that it provided people with an opportunity for early success. Although very simple to learn, Logo is by no means a toy language, and many people reached a point by the end of a week where they were writing sophisticated programs, for example, to play educational games, generate quizzes and poetry, draw complex images and create simulations. Seymour Papert's book Mindstorms (1) is perhaps the most accessible treatment of Logo that also provides a sense of the history, purpose and potential of the Logo programming language.

V. A Typical Logo Workshop Week

The workshop day ran from 8:30 AM to 4:30 PM for five days. Except for scheduled presentations, participants were free to choose their own activities. The week typically began by introducing the workshop facilitators (Henry Etlinger, Assistant Professor, Computer Science and Technology and Charles Collins, a graduate student in Computer Science and Technology, conducted all seven workshops), providing participants with a brief outline of the philosophy and rationale for the workshops, and distributing workshop materials. Each person was given a notebook (containing a weekly schedule, a progress record, some reference information regarding Logo and software packages, and two study guides), a copy of Apple Logo by Hal Abelson (BYTE Publications, 1982), and a blank floppy disk to use during the workshop (all workshop materials could be kept by participants afterwards). Before beginning the first presentation, a quick inspection of the Apple IIe computer was made and participants were oriented to the building in which the workshop was conducted (unlike its predecessor, the '83 workshops had a significant number of participants who were elementary or secondary school teachers from local school districts; of the one hundred participants in the Logo workshops, approximately twenty-five were not affiliated with RIT).

The workshop was conducted in a carefully structured and designed but informal manner. Workshop participants and facilitators quickly came to know one another on a first name basis. Each day there was a scheduled presentation ranging in duration from one to three hours. Except for these presentations, participants worked at their own pace, and to a large degree, on those aspects of the workshop that interested them the most.

The primary tool used to guide participants in their work were study guides designed by the authors (see Appendix for a listing of all units available). For the Logo component of the workshop, study guides typically introduced new topics, suggested very specific readings in the Abelson book, and provided people with exercises to try (see Appendix for a listing of the major sections in a typical study guide). When an individual felt they had completed a unit, they requested a problem from one of the instructors. The problem typically required an integration of the skills that a person had developed while studying a given unit. Participants could work on these projects completely on their own, or request as much assistance from the facilitators as they needed. The problems were not designed as punitive measures, but were designed to foster a sense of accomplishment and give participants a "target to shoot for". (see Appendix for shortened descriptions of several problems). The problems provided a mechanism by which participant and facilitator alike could recognize success or diagnose difficulties.

The readings on computer technology and terminology were contained right in the study guides for this component of the workshop. Each study guide contained questions that participants answered as they completed different sections of the reading. At the conclusion of each study guide, a facilitator and a participant would review the participant's answers to each of the study guide questions. Correct answers were reinforced and questions that were not answered correctly were explained more fully until the facilitator, probing with additional questions, was satisfied that the participant understood. When a person completed either a terminology unit or a Logo unit, a facilitator signed that person's progress record and gave them the next unit. In all, there were five terminology units and six Logo units that could be worked on. No one finished all eleven units and that was intentional. We tried to provide sufficient options so that people who came to the workshop with particular goals in mind would be satisfied. Adult learners in a workshop setting are capable of making informed decisions about the content and management of their own learning. For example, most of the people involved with elementary or secondary education came to the workshop primarily to learn about Logo (it was frequently the case that these individuals had been singled out to become the "Logo expert" for their school).
RIT faculty and staff enjoyed the work on Logo, but found even greater satisfaction and more direct relevance to their own needs in the presentations on software packages. Often they would pursue one of the three packages in greater depth. Formal and informal follow-up of workshop participants indicate that quite a few are now using these packages routinely.

The main idea behind the software presentations was to illustrate three very common and useful types of general purpose software packages, provide participants with an opportunity to work with a selected subset of features, and use remaining workshop time to learn to use a package in greater depth, if so desired. The three packages chosen for illustration were VisiCalc (from Visicorp) to illustrate spreadsheet applications, pfs:FILE (from Software Publishing Corp.) to illustrate a simple data management system, and Applewriter II to illustrate word processing. In each case, a tutorial document that was part reference guide and part exercise set was developed and used with participants. The software presentations also provided an opportunity for participants to work with partners. Most people enjoyed the chance to meet other people from the different colleges of RIT or other educational institutions. This aspect of the workshop helped foster a sense of community. Toward the end of the summer, the facilitators added "contests" to these sections that often provided for amusing and lighter moments to counter the serious side of the workshops. Since evaluation of the learning outcomes of these presentations were not mastery-based, they were not officially recorded on participant's progress records. Observational measures such as attendance at the presentations (usually 100%), the number of participants who chose to work further on one of the packages and the utilization of these packages after the workshop clearly suggest that this was as we'd hoped one of the more directly useful and valued components of the workshops.

To encourage further work, the facilitators brought in books and articles related to Logo and the software packages used. Several times during the summer, participants already familiar with personal computers brought in additional software (such as Krell Logo or Bank Street Writer) for people to look at. The workshops quickly became a highly participatory, interactive environment in which participants could explore and share new discoveries. In that respect, the workshop modeled the active learning environment we believe computers can greatly facilitate if used well.

The workshops were extensively evaluated. The primary instruments used were a survey of attitudes administered before the workshop began and a comprehensive evaluation administered on the last day of a workshop. The statistics cited here represent summary data based on 91 responses out of 107 participants. Questions could be answered on a five-point scale, with answers ranging from "strongly agree" (5.0) to "strongly disagree" (1.0). Participants found the Logo workshop (a) worthwhile (mean score = 4.63; standard deviation = +/- 0.57), (b) enjoyable (mean = 4.55; standard deviation = +/- 0.56), and (c) well organized (mean = 4.53; standard deviation = +/- 0.71). The three presentations on packaged software rated particularly high in contributing to the value of the workshop (mean = 4.72; standard deviation = +/- 0.45). Participants noted a distinct drop in anxiety about computers (mean = 4.11; standard deviation = +/- 0.79) and felt they had acquired a good foundation for subsequent learning about computers (mean = 4.37; standard deviation = +/- 0.59). Participants completed an average of 2.79 programming units (± 1.18 Std Dev), out of six possible.

The statistics from the evaluations are certainly comforting, but they don't reveal the entire story. Personal observations provide additional insight into why most participants enjoyed the workshops and also why most people genuinely learned new skills. The workshops are highly organized but self-paced structure supported exploration. Logistical slip-ups were rare and after several workshops, most printed materials were more finely polished. Participants enjoyed the open structure of the workshop and responded well to the variety of activities and modes of learning to choose from. Having facilitators there who were responsive, able to answer questions without unnecessary jargon and who were enthusiastic about the workshops, set a positive tone to the week. There were many informal conversations during a week about the applications of computers and the choices to be considered when buying hardware or software that provided guided application of new knowledge to participants' own settings.

VI. Future Directions

The Logo workshop was successful. A good reputation, both within RIT and in the surrounding communities, has generated demand to continue the workshop. In addition, workshop "graduates" (yes, there were personalized certificates handed out at the end of the week) have suggested several interesting "follow-up" ideas. For Logo advocates, a workshop dealing with the integration of Logo into a school's curriculum has been suggested. Such a workshop would focus on both techniques for introducing Logo into the classroom, as well as practical work in designing lesson plans, and developing suitable project ideas.

A second need expressed by participants has been for further work on software packages. There are two interests mentioned. The first is to continue with a look at the more advanced features of packages such as VisiCalc and word processing. A second idea is to review new packages and expand a participant's literacy in this area. Both additional Logo and additional software packages will be considered as workshops in planning for the summer, 1984.
VII. Conclusions

RIT has approached the issue of computer literacy for faculty and staff in an enjoyable and productive fashion. Workshops have been developed that offer the adult learner both freedom and guidance. Materials have been developed that provide a workshop participant with technical information, steps to follow in achieving well-stated objectives, and exercises and problems that demonstrate to the participant that they have mastered the stated objectives. More importantly, workshop participants have the support of interested facilitators as well as other participants in an environment that nurtures interest and learning. As evidenced by the workshop evaluations, by informal discussion, by increased interest by many participants in the master's program offered by the School of Computer Science, and by personal observation, the 1983 Logo workshops were a successful approach to making computing fun and useful for over one hundred people.

VIII. Acknowledgements

Part of the enjoyment of working on the Logo workshops was the fact that a team of supportive people were involved. We would like to thank Chuck Collins who helped facilitate the seven Logo workshops conducted in 1983. Chuck enthusiastically took on half of the work in developing the materials and conducting the workshops, but he deserves full credit for a job well done. Dr. Lawrence Belle (Assistant Vice President for Faculty and Program Development), thank you for giving Hank the winter to think about Logo again after so many years. Our thanks also go to Diane Sommers and the other FPD staff for tirelessly supporting the development and conducting of the Logo workshops. The "Computer Literacy Education and Training System" grant, funded by the New York State Department of Education, helped support the participation of elementary and secondary teachers in the workshop. Larry McKnight's and Terry Dennis' help with some software problems was much appreciated. And finally, thank you to over one hundred workshop participants whose acquaintance we had the pleasure of making and whose enthusiasm made us look good.

IX. References


APPENDIX

Units of Study for the Logo Workshop

The units on computers and terminology were selected readings collectively called "What's Under the Hood". The units were titled: (1) "Meet the Computer", (2) "Inside the Computer", (3) "Mass Storage Devices", (4) "Input/Output Devices", and (5) "Computer Graphics and CAD/CAM". The Logo units were titled:

(1) "Getting Started with Logo", (2) "Programming with Procedures", (3) "Numbers, Words, and Lists", (4) "Names and Conditions", (5) "Projects Using Numbers, Words, and Lists", and (6) "Advanced Logo Programming".

Study Guide Sections

A typical Logo study guide contained the following sections: (1) an introduction to provide an overview of the topics to be studied, (2) a list of objectives that specifically stated the learning outcome participants needed to achieve, (3) an activities checklist that provided guidance in reading the Abelson book and doing exercises, (4) additional readings that supplemented the book and provided some details for using the Apple IIe computer, and (5) a set of exercises that helped build masters prior to requesting the unit problem. The study guides for understanding computer technology and its application and common jargon followed the same general pattern for clarity and consistency.

Sample Logo Problems

By the summer's end, the facilitators had developed a battery of projects for each unit. While all enabled learners to demonstrate fundamental mastery, some problems were harder than others, and an attempt was usually made to assign a problem that was of interest and challenging to each participant. Some sample problems for the unit on procedures were: (1) developing a set of procedures to program the Logo turtle to draw a face; issues having to do with program development were discussed with this problem, (2) to develop a recursive program that drew a series of smaller and smaller flags, (3) to develop a program that could write out the participant's first name in block letters, and (4) to develop a program that drew several circles and crosses on the screen; this problem developed some facility with Logo's cartesian coordinate graphics primitives. The complexity of problems were deliberately limited so that people could solve them in a reasonable time period while demonstrating mastery.