

Old Dominion University

Reflective Status Report Fall 1996

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0. CPI Background

The Computer Productivity Initiative moved from the conceptual stage into implementation with the combined NSF and ODU funding in 1992. The initiative is a modification to the traditional computer science curriculum to better prepare new computer professionals for their careers. The major modification incorporates a multi-semester project based set of senior courses. The general necessity for productivity increase has been identified on many fronts (study results, ACM Task Force reports, NSF Education Workshop reports, and commercial reviews).

The practical experience gained by the students is manifested by the coupling of classroom theory with productivity achievements in solving the broad range of infrastructure problems associated with establishing, designing, and managing a relatively large project. Project team members develop the skills to effectively perform technical and marketing research. They cope with the many problems facing the project manager from resource management, scheduling, planning, cost management to the preparation and delivery of project reports.

The initial course takes the project from the creative stage and provides a sound functional description of the project solution. This course uses a presentation based scenario that culminates in the production of the prime deliverable, the functional specifications. The specifications must be provided in a suitable form to convince upper management (role of the external advisory board of practicing professionals) that continuation of the project is functionally sound. The follow on course is demonstration based that uses a combination of prototyping and simulation to identify the project's risk factors. The analysis of risk provides the basis for the system design solution for the project. This design solution is the prime deliverable and is in a form that could be used to produce the product or provide the service of the project's requirements. This deliverable is a set of detailed specifications that will convince the advisory board that the project should move into the development stage.

1. Overview of Goals and Objectives

Five subgoals were established to meet the overall CPI goal.

- Multi-year project experience - not semester limited
- Experience beyond computer science - real life project
- Exposure to leading edge technologies
- Introduction to principles of productivity
- Portable curriculum

The development of the multi-year project was accomplished early in the CPI history. While the definition of the process was relatively easy, the implementation was filled with several hurdles. Several tangible benefits of the multi-year (or semester) approach have been observed. Students obtain experience of the entire project development cycle, from the initial idea through the design and pre-implementation phases. This breadth of involvement cannot be obtained in the traditional semester based project. The details of the design phase are in much greater depth than time permitting in a semester. This depth provides students with the critical knowledge implementation skills that industry reports are critical for a productive professional. Students are exposed to application of effective alternatives to insurmountable or unexpected problems and are allowed to both temporarily fail but apply skills to correct the problems and return to a satisfactory project status. Little time if any is available in a single semester project for

reevaluation and redefinition of flawed designs or inadequate decisions in a semester project. Semester projects by definition must be designed for success. The multi-year project can be allowed to proceed with flaws, for time is available for an in process review and productive application of correction methods; precisely in tune with current business projects.

The CPI approach of real world project necessitates the involvement of students in many areas of project management that are remote to the computer science field. Financial cost analysis, resource management of large groups of personnel and equipment, marketing analysis of trends and expectations, and the domain knowledge of the project's domain are just a few of the observed skills that CPI has provided to the students. This breadth of application of the computer skills has been heralded by industry and management as special skills of the CPI graduates that are not generally observed in other new professionals.

The frightening increasing pace of technology implementation is a constant hurdle of all educational programs. The hurdle must be overcome to insure that the productivity levels of graduates are sufficiently high to be judged as professionals in the application of the educational theory and knowledge. The use of current projects from industry and military partners mandates the use of current and development of future technology. The final course deliverables of the detail specifications of the project must employ the most current technological applications in order to be sufficient. One of the most recent projects was so sufficiently adequate in the use of technology that it received funding from the customer for the project preliminary design and implementation. The CPI commitment to both employ current projects and provide leading edge technological resources for students has been noted in several advisory board meetings as "just the proper degree of edge" necessary for the CPI students to excel in comparison to other professional contemporaries.

Throughout the CPI courses the principles of productive utilization of resources, computer systems, and support equipment are emphasized. Commercial Off The Shelf (COTS) systems are recommended for integration into the project design solution. The risk factors of new system design are critical concerns of the detailed system design deliverable. The advisory board has routinely commented upon this design factor as one of the most important positive elements of the project designs that have been reviewed to date. The board's comments have emphasized the in process guidance provided during the project's life.

The CPI goal of developing a portable curriculum remains one of the few sub-goals that has yet to be demonstrated, observed, or received a positive review. The open announcement and advertising of the availability of the course materials etc., the enthusiastic conference attendees and even a direct attempt of cooperative insertion of the CPI concept into another university have all met with enthusiastic rejection. It would appear the necessity of a dedicated CPI coordinator and the "not invented here" syndrome are the causes for not being able to demonstrate the portability of the CPI concept. While efforts have not ceased to transfer the concept, the avenues available for success in this area seem to be closed.

2. Current Status and Accomplishments

Most reflective evaluations of multi-year efforts such as CPI identify several unexpected achievements. CPI is not an exception.

During the implementation phase of CPI, a university wide initiative was identified, the Curriculum Practicum. The university's goal had remarkably similar characteristics to those of CPI and several of the Practicum goals were virtually identical to those of CPI. The immediate identification of CPI as the Computer Science department's practicum was not accepted as meeting the university's requirements, but received mention for the rapid design and development of the practicum experience for all university majors.

One of the early hurdles that CPI had to overcome was the enrollment issue; the necessity of achieving sufficient interest and enrollment by students to both offer the course and have a student population that would meet the course goals. The early course offerings received a small but sufficient enrollment. The university initiated a major distance learning program that offers the university degree programs to students throughout the Commonwealth of Virginia via satellite video and phone bridge networked audio. The introduction of CPI to the distance learning environment has shown a doubling of student enrollment, that just barely exceeds the design course maximum in its first offering. In addition, this offering included a graduate level section that as well exceeded the expectations of interest and

enrollment. This high enrollment represents a student interest in the description of the courses that exceeds the expectations.

At the outset of CPI it was recognized that the ability to properly evaluate the expected goal of increased professional productivity was a difficult effort. The evaluation degree of difficulty has not changed. Recently a few of the former CPI students have reported that they find the experiences of CPI are not only useful to their daily professional efforts, but in some cases allow them to be singled out in their environment as selected members of their staffs to use the CPI skills and knowledge that others in their offices do not possess. This unexpected set of testimonials is gratifying, but considering the timing (just a few short months or a year after CPI), the productivity factor goal appears to have been in some cases achieved in record time.

While the increased size of the CPI registered student base has dramatically increased, this double-edged sword has also identified another impact of the increase. The number of students and the necessity of infrastructure support of these students indicates a new burden, that may have been discussed some time ago, is now reality. The close coordination required to effectively maintain a single class project is an effort that is reasonably managed. Even three or four simultaneous projects can be managed quite efficiently. A large number of students however, presents a much larger number of projects, and requires an increased infrastructure support that exceeds the original content of CPI. Size is clearly a limiting factor, a factor that has not been a concern until recently.

3. Plans for Remainder of Project

This project was completed over a year ago. The CPI curriculum is now required for all Computer Science students.

4. Materials That Have Been Developed

We have developed a set of background material which is available through the CPI web site ([HYPERLINK http://www.cs.odu.edu/~cpi](http://www.cs.odu.edu/~cpi) <http://www.cs.odu.edu/~cpi>). This material includes:

- The CPI contract: Because of the non-traditional nature of CPI curriculum, evaluation done during a "performance" review at the middle and end of the semesters.
- The CPI contract, which each student signs, outlines the objectives of the course.
- Students document progress towards these objectives in weekly progress reports (kept in their web pages). Slides for selected topics (project management, interviewing, problem solving).
- Various resources which have proven to be of use in past projects (HTML tools, publicly available presentation material such as icons, bitmaps, etc)
- Descriptions of past projects undertaken

5. Dissemination Activities

We have published in numerous conferences and given invited talks about the CPI project. The availability of material on the CPI website has also contributed to dissemination. In fact this WEBSITE was referenced at the most recent SNOWBIRD conference as an example of innovations in teaching approaches.

6. Evaluation Activities

This evaluation is based upon the accumulation of expressed views of individuals associated with CPI. These participants include CPI students, the associated and review faculty members, university faculty and staff administrators, members of the external professional advisory board, and former CPI students as practicing professionals.

The evaluation data includes not only the written comments from the various CPI participants but as well the empirical accounting data. This data includes workload (faculty and student), administrative costs, and equipment and facility costs. Other factors include the minutes of advisory board and

administrative meetings. The audience response and impressions at the conference presentations of CPI reports are also factors of evaluation.

While the bulk of evaluation summaries, views and empirical data are laudatory and supportive, several weighting factors must be considered when analyzing the various reports. Four factors are critical for the proper use of evaluation information. These factors include the source of the evaluation, the timing of when the evaluation was made, the estimated motivation for the evaluation comments, and whether the expressed view was an isolated view or a duplication of another view (multiple accounts of the same or similar viewpoint).

7. Benefits Seen and Expected.

Several students have remarked that they felt that the CPI experience was beneficial and helped in interviewing for prospective jobs. It usually becomes a point of discussion during the interview. Also the experience of presenting the final report to an executive board, which consists of managers and professional who are outside of the University, helps prepare the students for job interviewing. In addition, this program has been enthusiastically received by the community who perceive a potential benefit to themselves from the analysis done by the students on real problems of interest to the outside community.