

Materials to Support Teaching a Project-Intensive Introduction to Software Engineering

James E. Tomayko

July 1991

EDUCATIONAL MATERIALS
CMU/SEI-91-EM-006

Unlimited distribution subject to the copyright.

<http://www.sei.cmu.edu>

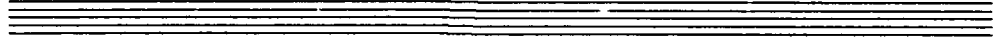


Educational Materials

CMU/SEI-91-EM-6

July 1991

**Materials to Support Teaching a
Project-Intensive Introduction
to Software Engineering**



James E. Tomayko

Carnegie Mellon University
School of Computer Science and
Software Engineering Institute

Approved for public release.
Distribution unlimited.

Software Engineering Institute
Carnegie Mellon University
Pittsburgh, Pennsylvania 15213

[Faint, illegible text, possibly a stamp or signature]

A-1

This document was prepared for the


SEI Joint Program Office
ESD/AVS
Hanscom AFB, MA 01731

The ideas and findings in this document should not be construed as an official DoD position. It is published in the interest of scientific and technical information exchange.

Review and Approval

This document has been reviewed and is approved for publication.

FOR THE COMMANDER


Charles J. Ryan, Major, USAF
SEI Joint Program Office

The Software Engineering Institute is sponsored by the U.S. Department of Defense.
This report was funded by the Department of Defense.

Copyright © 1991 by Carnegie Mellon University.

This document is available through the Defense Technical Information Center. DTIC provides access to and transfer of scientific and technical information for DoD personnel, DoD contractors and potential contractors, and other U.S. Government agency personnel and their contractors. To obtain a copy, please contact DTIC directly: Defense Technical Information Center, Attn: FDRA, Cameron Station, Alexandria, VA 22304-6145.

Copies of this document are also available through the National Technical Information Service. For information on ordering, please contact NTIS directly: National Technical Information Service, U.S. Department of Commerce, Springfield, VA 22161.

Use of any trademarks in this document is not intended in any way to infringe on the rights of the trademark holder.

Materials to Support Teaching a Project-Intensive Introduction to Software Engineering

Abstract

In a project-intensive introduction to software engineering at Carnegie Mellon University (CMU), students developed an interactive exhibit for the Kansas Cosmosphere and Space Center. In a similar course at The Wichita State University, students modified the original CMU project to fit new customer requirements. This package of educational materials provides the software products and documents developed by the students in these courses, along with lesson plans, exams, and other materials used by the instructors.

This educational materials package is based on an undergraduate software engineering course that I taught at Carnegie Mellon University (CMU) in the fall of 1990. The centerpiece of this project-intensive course was the development, for the Kansas Cosmosphere and Space Center, of an interactive exhibit that demonstrates orbital mechanics.

This package is a revision of the support materials for my earlier technical report, *Teaching a Project-Intensive Introduction to Software Engineering* (CMU/SEI-87-TR-20). That report contains a survey of the various types of software engineering introductory courses, a description of how to get started teaching a course that uses the class project as the central learning experience, and detailed lesson plans from a course taught at CMU in 1986. At the end of the report is an order form for 800 pages of supplementary materials, such as sample instructor's handouts and student-developed documents. This educational materials package is similar in nature.

Several SEI publications update and, hopefully, improve upon the information in the original report. For example, *Models for Undergraduate Courses in Software Engineering* (CMU/SEI-91-TR-10) by Mary Shaw and myself is a comprehensive survey of nearly all the software engineering courses taught in the United States. It contains descriptions of various styles of teaching the courses, information on the most popular texts and techniques, and advice on choosing projects and organizing student teams. This educational materials package is a detailed implementation of one of the styles. Readers will find it helpful to read either the original technical report (87-TR-20) or the Shaw and Tomayko report (91-TR-10) prior to using the materials in this package.

All the documents and software in this educational materials package (including this introduction) are available in electronic form. The set of diskettes includes three versions of students' software: a Macintosh-compatible version that demonstrates rendezvous techniques, a similar program that is MS-DOS compatible, and an MS-DOS compatible modification that demonstrates orbit changes.

The latter software was developed by a class using a prototype version of this educational materials package. In the spring of 1991, Peggy Wright of The Wichita State University taught an introductory software engineering course whose project was to modify the original CMU product to more closely fit new customer requirements. A summary of that course offering appears in this package, as well as the executable version of the modified product.

Package Contents

The set of thirteen 3.5-inch diskettes contains the following documents and software (all documents are provided in both Word format and plain text):

Disk 1: Materials useful for the instructor, such as lesson plans for each class session, overhead slides (PowerPoint format), exams, a syllabus, activity network (MacProject format), organizational charts (MacDraw format), and other items from both the Tomayko and Wright versions of the course.

Disk 2: The Word version of documents generated by students during development: the requirements specification, preliminary and detailed design, integration and test plans, and others.

Disk 3: The plain text version of the documents on Disk 2.

Disk 4: Documents that support controlling the development process, such as the quality assurance, configuration management, and independent verification and validation plans (Word and plain text formats).

Disk 5: The Word version of documents that support the delivery of the product: the user guides, maintenance manual, version description document, etc.

Disk 6: The plain text version of the documents on Disk 5.

Disks 7-8: Source code and resource files for the Macintosh version of the product.

Disk 9: Bitmaps used to develop the graphics in the product.

Disk 10: The executable Macintosh version of the product.

Disk 11: Source code for the PC version of the product (MS-DOS diskette format).

Disk 12: The executable PC version of the product (MS-DOS diskette format).

Disk 13: The executable PC version of the product as modified by the class at Wichita State (MS-DOS diskette format).

How to Use This Material

There are three primary ways to use the materials in this package:

1. Build a course similar to the course documented here, using the student-generated documents (on Disks 2-5) as examples for your students to follow.
2. Use the requirements specification document (on Disk 2) as a basis for building a completely new version of the software.
3. Use the supplied software (on Disks 7, 8, 9, 11, and 13) as the basis for modifications and extensions.

The current version of the software does not fully meet its specifications, so one possible modification project would be to test the software against the user manual (on Disks 5-6), identify the discrepancies, and then fix them. An alternative possibility is a significant modification such as that done by Wichita State (see Wright's notes on Disk 1).

How to Order Diskettes

To obtain the diskettes containing the educational materials, please send the following order form to the SEI Education Program.



Order Form for EM-6 Diskettes

Educational materials package CMU/SEI-91-EM-6 contains the software product and documents developed by students, along with lesson plans, exams, and other materials used by the instructors in two project-intensive courses.

To receive the package, a set of thirteen 3.5-inch diskettes, complete this form and return it with \$15.00 payment to:

Education Program
Software Engineering Institute
Carnegie Mellon University
Pittsburgh, PA 15213-3890

Checks should be made payable to **Carnegie Mellon University** and should accompany this order form.

Name _____

Address _____

Amount enclosed \$ _____ (\$15.00 per set)

REPORT DOCUMENTATION PAGE

1a. REPORT SECURITY CLASSIFICATION Unclassified			1b. RESTRICTIVE MARKINGS None								
2a. SECURITY CLASSIFICATION AUTHORITY N/A			3. DISTRIBUTION/AVAILABILITY OF REPORT Approved for Public Release Distribution Unlimited								
2b. DECLASSIFICATION/DOWNGRADING SCHEDULE N/A											
4. PERFORMING ORGANIZATION REPORT NUMBER(S) CMU/SEI-91-EM-6			5. MONITORING ORGANIZATION REPORT NUMBER(S) Educational Materials								
6a. NAME OF PERFORMING ORGANIZATION Software Engineering Institute		6b. OFFICE SYMBOL (if applicable) SEI	7a. NAME OF MONITORING ORGANIZATION SEI Joint Program Office								
6c. ADDRESS (City, State and ZIP Code) Carnegie Mellon University Pittsburgh PA 15213			7b. ADDRESS (City, State and ZIP Code) ESD/AVS Hanscom Air Force Base, MA 01731								
8a. NAME OF FUNDING/SPONSORING ORGANIZATION SEI Joint Program Office		8b. OFFICE SYMBOL (if applicable) ESD/AVS	9. PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER F1962890C0003								
8c. ADDRESS (City, State and ZIP Code) Carnegie Mellon University Pittsburgh PA 15213			10. SOURCE OF FUNDING NOS.								
			<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th style="text-align: left;">PROGRAM ELEMENT NO</th> <th style="text-align: left;">PROJECT NO.</th> <th style="text-align: left;">TASK NO</th> <th style="text-align: left;">WORK UNIT NO.</th> </tr> <tr> <td>63756E</td> <td>N/A</td> <td>N/A</td> <td>N/A</td> </tr> </table>	PROGRAM ELEMENT NO	PROJECT NO.	TASK NO	WORK UNIT NO.	63756E	N/A	N/A	N/A
PROGRAM ELEMENT NO	PROJECT NO.	TASK NO	WORK UNIT NO.								
63756E	N/A	N/A	N/A								
11. TITLE (Include Security Classification) Materials to Support Teaching a Project-Intensive Introduction to Software Engineering											
12. PERSONAL AUTHOR(S) James E. Tomayko											
13a. TYPE OF REPORT Final		13b. TIME COVERED FROM: TO:		14. DATE OF REPORT (Yr., Mo., Day) July 1991							
15. PAGE COUNT 10 pp.											
16. SUPPLEMENTARY NOTATION											
17. COSATI CODES			18. SUBJECT TERMS (Continue on reverse if necessary and identify by block number) software engineering education project courses software management								
FIELD	GROUP	SUB. GR.									
19. ABSTRACT (Continue on reverse if necessary and identify by block number) In a project-intensive introduction to software engineering at Carnegie Mellon University (CMU), students developed an interactive exhibit for the Kansas Cosmosphere and Space Center. In a similar course at The Wichita State University, students modified the original object to fit new customer requirements. This package of educational materials provides the software products and documents developed by the students in these courses, along with lesson plans, exams, and other materials used by the instructors.											
(please turn over)											
20. DISTRIBUTION/AVAILABILITY OF ABSTRACT UNCLASSIFIED/UNLIMITED SAME AS RPTDTIC USERS			21. ABSTRACT SECURITY CLASSIFICATION Unclassified, Unlimited Distribution								
22a. NAME OF RESPONSIBLE INDIVIDUAL Charles J. Ryan, Major, USAF			22b. TELEPHONE NUMBER (Include Area Code) (412) 268-7631		22c. OFFICE SYMBOL ESD/AVS (SEI)						

ABSTRACT —continued from page one, block 19

The Software Engineering Institute (SEI) is a federally funded research and development center, operated by Carnegie Mellon University under contract with the United States Department of Defense.

The SEI Graduate Curriculum Project is developing a wide range of materials to support software engineering education. A *curriculum module* (CM) identifies and outlines the content of a specific topic area, and is intended to be used by an instructor in designing a course. A *support materials* package (SM) contains materials related to a module that may be helpful in teaching a course. An *educational materials* package (EM) contains other materials not necessarily related to a curriculum module. Other publications include software engineering curriculum recommendations and course designs.

SEI educational materials are being made available to educators throughout the academic, industrial, and government communities. The use of these materials in a course does not in any way constitute an endorsement of the course by the SEI, by Carnegie Mellon University, or by the United States government.

Permission to make copies or derivative works of SEI curriculum modules, support materials, and educational materials is granted, without fee, provided that the copies and derivative works are not made or distributed for direct commercial advantage, and that all copies and derivative works cite the original document by name, author's name, and document number and give notice that the copying is by permission of Carnegie Mellon University.

Comments on SEI educational materials and requests for additional information should be addressed to the Education Program, Software Engineering Institute, Carnegie Mellon University, Pittsburgh, Pennsylvania 15213. Electronic mail can be sent to education@sei.cmu.edu on the Internet.

Curriculum Modules (* Support Materials available)

CM-1 [superseded by CM-19]
CM-2 Introduction to Software Design
CM-3 The Software Technical Review Process*
CM-4 Software Configuration Management*
CM-5 Information Protection
CM-6 Software Safety
CM-7 Assurance of Software Quality
CM-8 Formal Specification of Software*
CM-9 Unit Testing and Analysis
CM-10 Models of Software Evolution: Life Cycle and Process
CM-11 Software Specifications: A Framework
CM-12 Software Metrics
CM-13 Introduction to Software Verification and Validation
CM-14 Intellectual Property Protection for Software
CM-15 [no longer available]
CM-16 Software Development Using VDM
CM-17 User Interface Development*
CM-18 [superseded by CM-23]
CM-19 Software Requirements
CM-20 Formal Verification of Programs
CM-21 Software Project Management
CM-22 Software Design Methods for Real-Time Systems*
CM-23 Technical Writing for Software Engineers
CM-24 Concepts of Concurrent Programming
CM-25 Language and System Support for Concurrent Programming*
CM-26 Understanding Program Dependencies

Educational Materials

EM-1 Software Maintenance Exercises for a Software Engineering Project Course
EM-2 APSE Interactive Monitor: An Artifact for Software Engineering Education
EM-3 Reading Computer Programs: Instructor's Guide and Exercises
EM-4 A Software Engineering Project Course with a Real Client
EM-5 Scenes of Software Inspections: Video Dramatizations for the Classroom
EM-6 Materials to Support Teaching a Project-Intensive Introduction to Software Engineering