

The Personal Software ProcessSM (PSPSM): A Practitioner's View

presented by

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Overview

- What is the Personal Software Process?
- Main elements of the PSP
- The PSP and the CMM
- PSP experience: student data
- PSP experience: industry data
- Cost benefit analysis
- My data
- Conclusion

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What is the PSP?

- The PSP was developed by SEI Fellow Watts Humphrey as a follow-on to his groundbreaking work in organizational software processes.
- The PSP scales down software processes to a level suitable for individual use.

Why do we need a PSP?

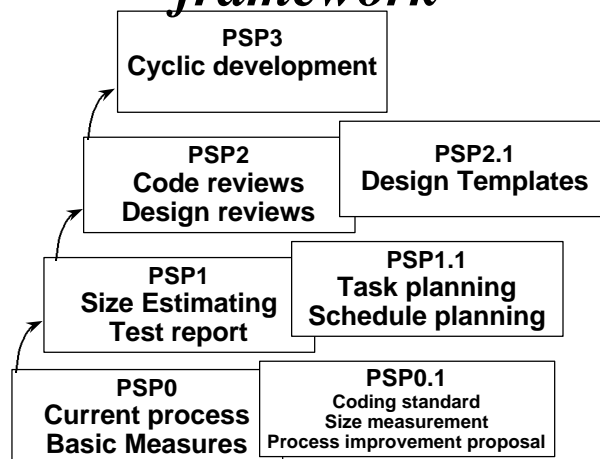
- Individual developers cannot improve by just trying harder.
- The PSP teaches software practitioners how to plan, measure, test, analyze, and improve their work.

	Unconscious	Conscious
Incompetence	Stage 1	Stage 2
Competence	Stage 4	Stage 3

Source: William F. Hayes, "Quality and Leadership"

Elements of the PSP

PSP: A defined and measured framework



Source: *A Discipline for Software Engineering* by Watts Humphrey

PSP0

The Baseline Personal Process

- Add measurements to current process
- Time log
 - record time spent in minutes per process phase
- Defect log
 - record compile defects
 - record unit test defects

PSP0.1

The Baseline Personal Process

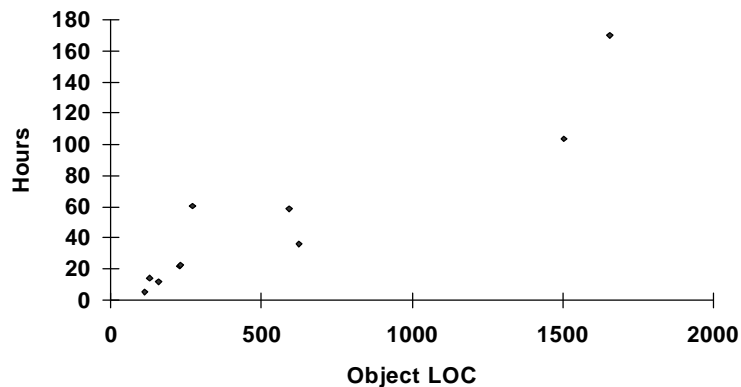
- Define defect type standard
- Define coding standard
 - used later to calculate program size (LOC)
- Add Process Improvement Proposals
 - record problems with process being used
 - record ideas for process improvement

PSP1

The Personal Planning Process

- The following planning elements are added to PSP0
 - Size estimating using the PROBE method
 - Time estimating
 - Test reports

Object LOC Correlation with Development Hours



Source: Carnegie Mellon University SEI

PSP1.1

The Personal Planning Process

- Resource estimating
- Schedule planning
- Earned Value Tracking

PSP 2

Personal Quality Management

- The following quality elements are added to PSP1
 - Code reviews
 - Design reviews
 - Quality measurements
 - Yield, test defects/KLOC, total defects/KLOC
 - defect estimates, and defect removal efficiencies

PSP2.1

The Personal Quality Process

- Design templates
- Additional quality measurements
 - Failure COQ
 - $(\text{compile time} + \text{test time}) / (\text{total development time})$
 - Appraisal COQ
 - $(\text{DR time} + \text{CR time}) / (\text{total development time})$
 - Appraisal/Failure cost ratio
 - PSP data shows A/FR of around 2 is optimal

PSP 3

Cyclic Personal Process

- Refines the process to address development of larger programs.
- Changes the PSP from a linear process to a cyclic process.
- Introduces high-level design and high-level design reviews to the PSP.

The PSP Quality Message

- The PSP teaches engineers that quality software is their personal responsibility.
- Their objective is to remove all defects before the first compile.
- When a program has many defects in compile, it will likely have many defects in unit test, system test, and in the field.

The PSP and the CMM

The PSP and the CMM

- While the CMM addresses organizational practices, the PSP addresses the practices followed by individual engineers.
- The CMM and PSP support each other.
- PSP training can accelerate an organization's CMM process improvement efforts.

PSP Elements in the CMM

KPA's addressed by
PSP*

5. Optimizing

Process change management*
Technology change
management*
Defect prevention*

4. Managed

Software Quality measurement*
Quantitative process management*

3. Defined

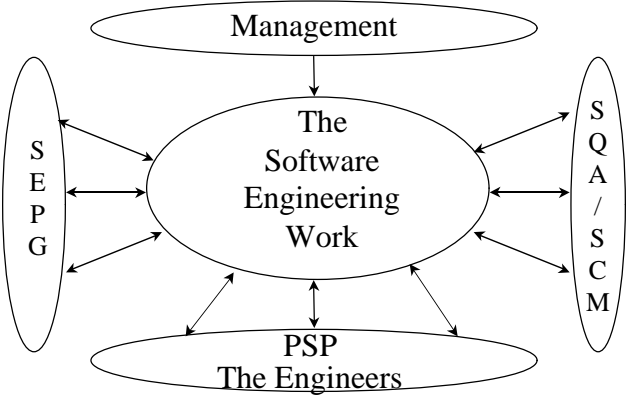
Peer Reviews*
Intergroup coordination
Software product engineering*
Integrated software management*
Training program
Organization process definition*
Organization process focus*

2. Repeatable

Software configuration management
Software quality assurance
Software subcontract management
Software project tracking and oversight*
Software project planning*
Requirements management

1. Initial

PSP and CMM



Source: Carnegie Mellon University SEI, sponsored by US DoD.

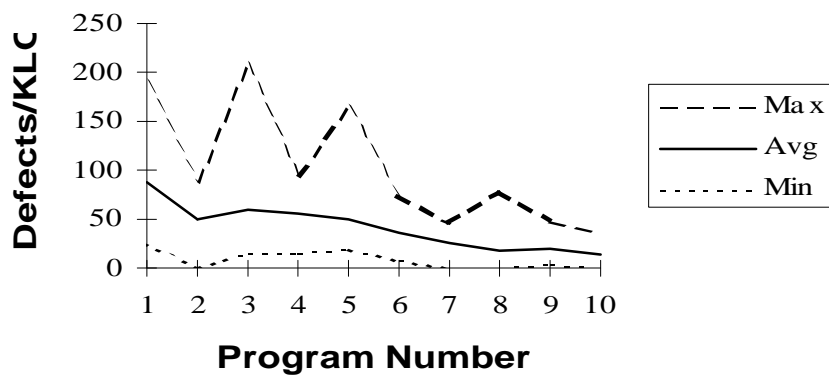
SEPG - software engineering process group
SQA - software quality assurance
SCM - software configuration management

PSP Experience: Student Data

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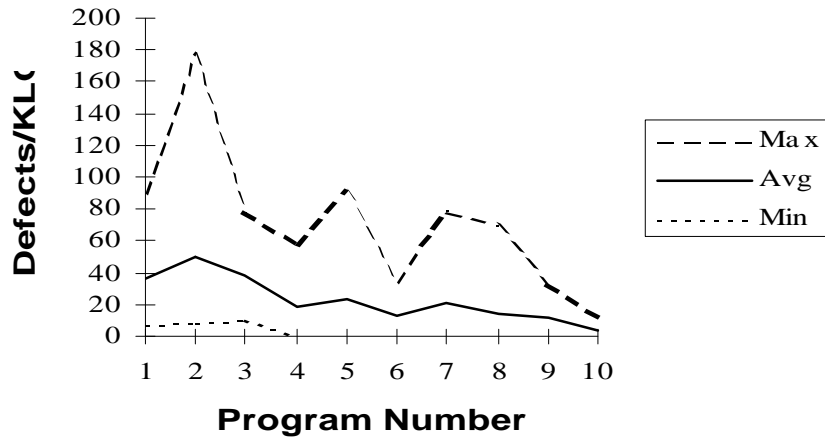
- The following data are from two sources:
 - 14 CMU students who took the course in 1994
 - 104 engineers in university and industry PSP courses
- These results are typical of the results obtained from most PSP courses.
- Students write program 1 using PSP0.
- They progress to PSP3 by the time they write program 10.

Defects Found in Compile - Range



Source: Carnegie Mellon University SEI

Defects Found in Test - Range



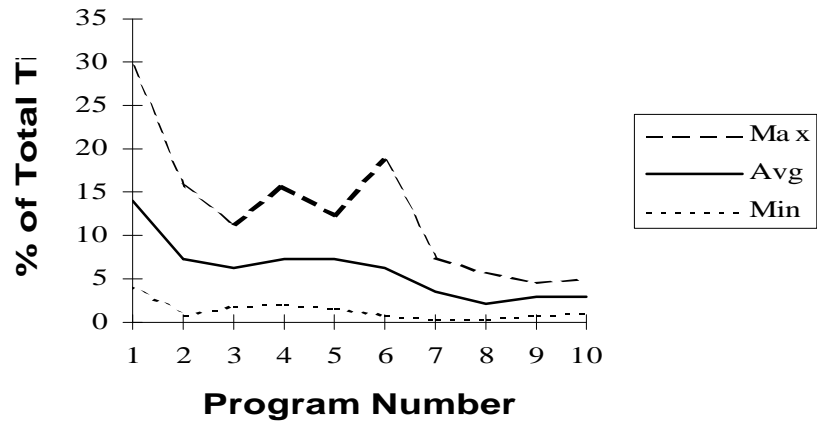
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Compile Time Range



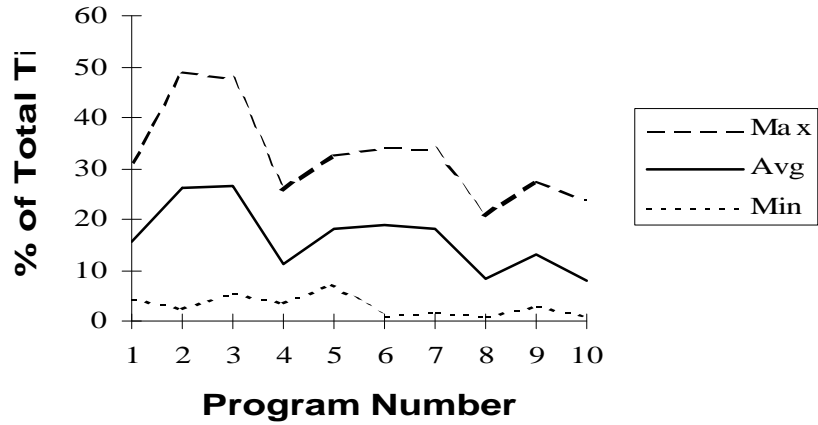
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Test Time Range



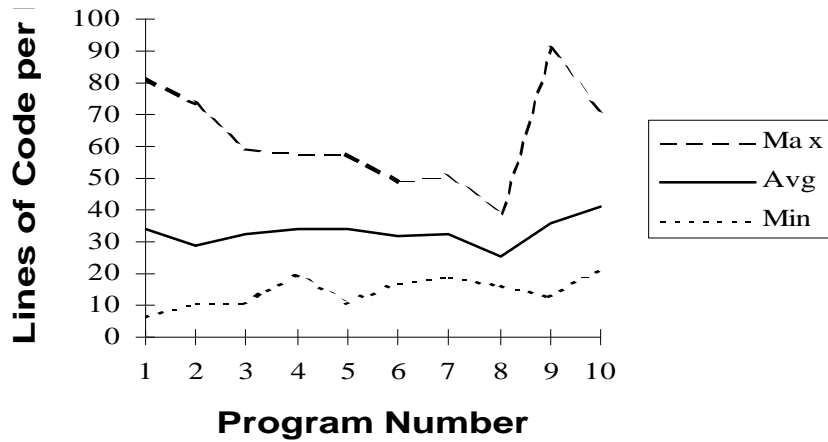
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Productivity Range



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PSP Experience: Industry Data

PSP Experience : Industry Data

Summary of AIS project data						
Project	PSP staff	Non-PSP staff	Product size	Planned/actual (months)	Acceptance test defects	Usage defects
B	3	0	24 reqs.	7/5	1	0
C	0	3	19 reqs.	2/5	11	1
D	0	3	30 reqs.	10/19	6	14
E	1	0	2255 LOC	6/6	0	0
F	1	0	1400 LOC	2/2	0	0
G	2	1	6196 LOC	2/2	0	3

Source: IEEE Computer, May 1997

PSP Experience: Industry Data (cont.)

Motorola operational defect data for PSP projects

Number of Projects	Total Size (LOC)	Test Defects	Field Defects
18	25,114	136	1

Source: IEEE Computer, May 1997

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PSP Experience: Industry Data (cont.)

US&S operational defect data for PSP projects

Number of Projects	Size (LOC)	Test Defects	Field Defects
5	8416	57	0

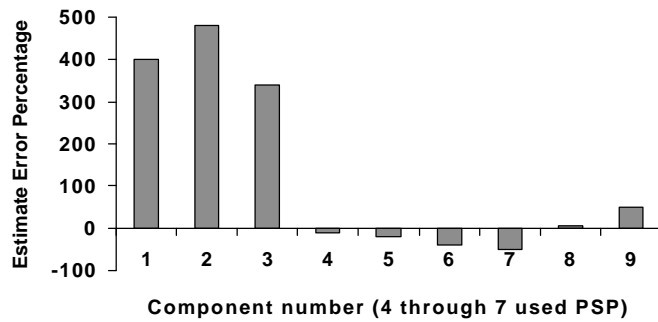
Source: IEEE Computer, May 1997

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PSP Experience: Industry Data AIS Schedule Estimating Error



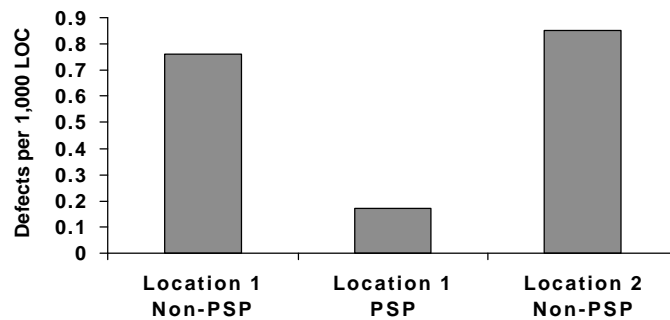
Source: IEEE Computer, May 1997

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PSP Experience: Industry Data AIS Acceptance Test Quality



Source: IEEE Computer, May 1997

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PSP Cost Benefit Analysis

Case 1:PSP Benefits

	Before PSP	After PSP
Defects/KLOC into unit test	33.8	9.5
Yield for unit test (% of total defects found in unit test)	50%	50%
Defects/KLOC into integration and system (I&S) test	16.9	4.75
I&S test fix time/defect	10 hours	10 hours
I&S test defect fix time/KLOC	169 hours	47.5 hours
PSP Savings per KLOC	121.5 hours	

Case 1: PSP Cost Recovery

Assume 10 engineers are working on a project	
Total student training hours	1500 hours
Cost of adapting PSP for current project	300 hours
Total cost of training	1800 hours
Savings per KLOC from PSP	121.5 hours
Training cost recovered	First 15 KLOC written by PSP trained team

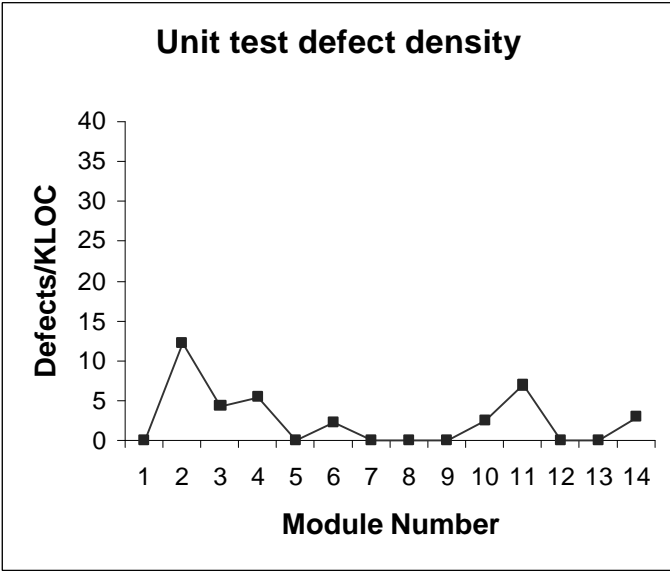
Case 2: PSP Benefits

Assume typical software project	
Lines of code	50,000
Number of engineers	5
LOC/Hour	20
Development hours per engineer a week	30
Cost to fix field reported defect	\$4,000

Case 2: PSP Benefits

	Without PSP	With PSP
Hours to write 50000 LOC	2500	2500
Defects into unit test	1690	475
Defects into Integration & System test	845	237.5
Hours to fix Integration & System test defects	8450	2375
Total hours to delivery	10950	4875
Delivery in weeks	73	32.5
Defects delivered to field	422.5	118.5
LOC/Hour through delivery	4.6	10.3
Service cost	\$1,690,000	\$475,000

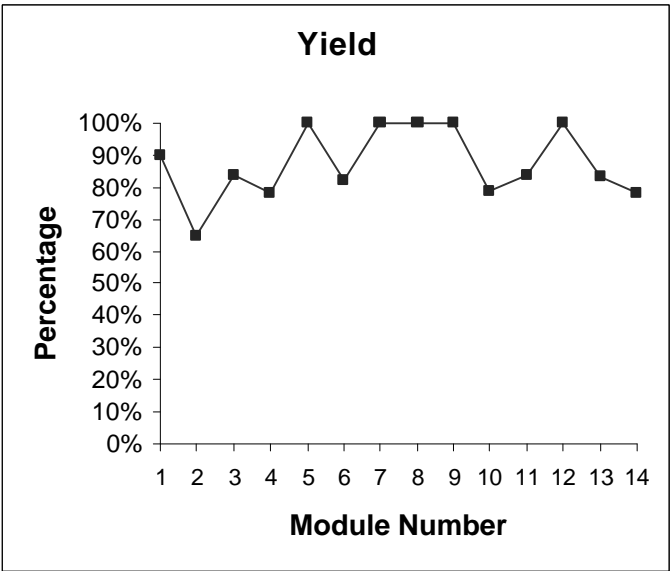
My Data



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Conclusions

- PSP lets you prove to yourself the effectiveness of your process.
- You see results very quickly.
- PSP does require discipline and commitment.
- With PSP, data rules!

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