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# What Works Best with TSPi for Small Team Productivity and Quality


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# TSPi Effectiveness with Small Teams


- TSPi impact on software teams
  - 23 teams of 7 to 12 graduate students on real world developments
  - Software process awareness and impact
    - **Productivity coupled with quality**
    - **Result of planning and analysis**
    - **Extensive data collection**
- Bringing real world software experience to the classroom
  - R&D leadership in communications companies
  - Land line, wireless, satellite, private and public networks
    - **Voice, data, land line, mobile, satellite, network management**



# What Results?

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- Data Summary – Productivity
  - Source Lines of Code (LOC) per Person Hour
    - High 47.4
    - Average 13.5
    - Low 1.8

    (complete Cycle 2 development, including reuse – all phases)
- Data Summary – Quality
  - Defects Injected per Total KLOC
    - Low 2.8
    - Average 24.1
    - High 86.3

# How do the teams work?

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- Team composition
  - **Students assigned to Team**
    - » **Based on From INFO**
  - **Roles matched to background**
  - **Demographic mixture**
  - **Well trained individual programmers**
- Learning environment
  - **14 to 17 weeks of class**
  - **Strict enforcement of team discipline**
  - **Face to face team meetings required**
  - **Students ? Employees, but can be "fired"**

Team Phoenix

Fall 2001

# Team Roles at a Glance

## (Five Specialized Roles)

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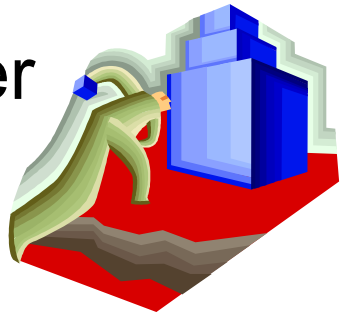
- Support Manager



- Quality/Process Manager

- **Development Manager**

- Planning Manager

- **Team Leader**

# Team Productivity – Cycle 2

## Source Lines Of Code (LOC) per Hour

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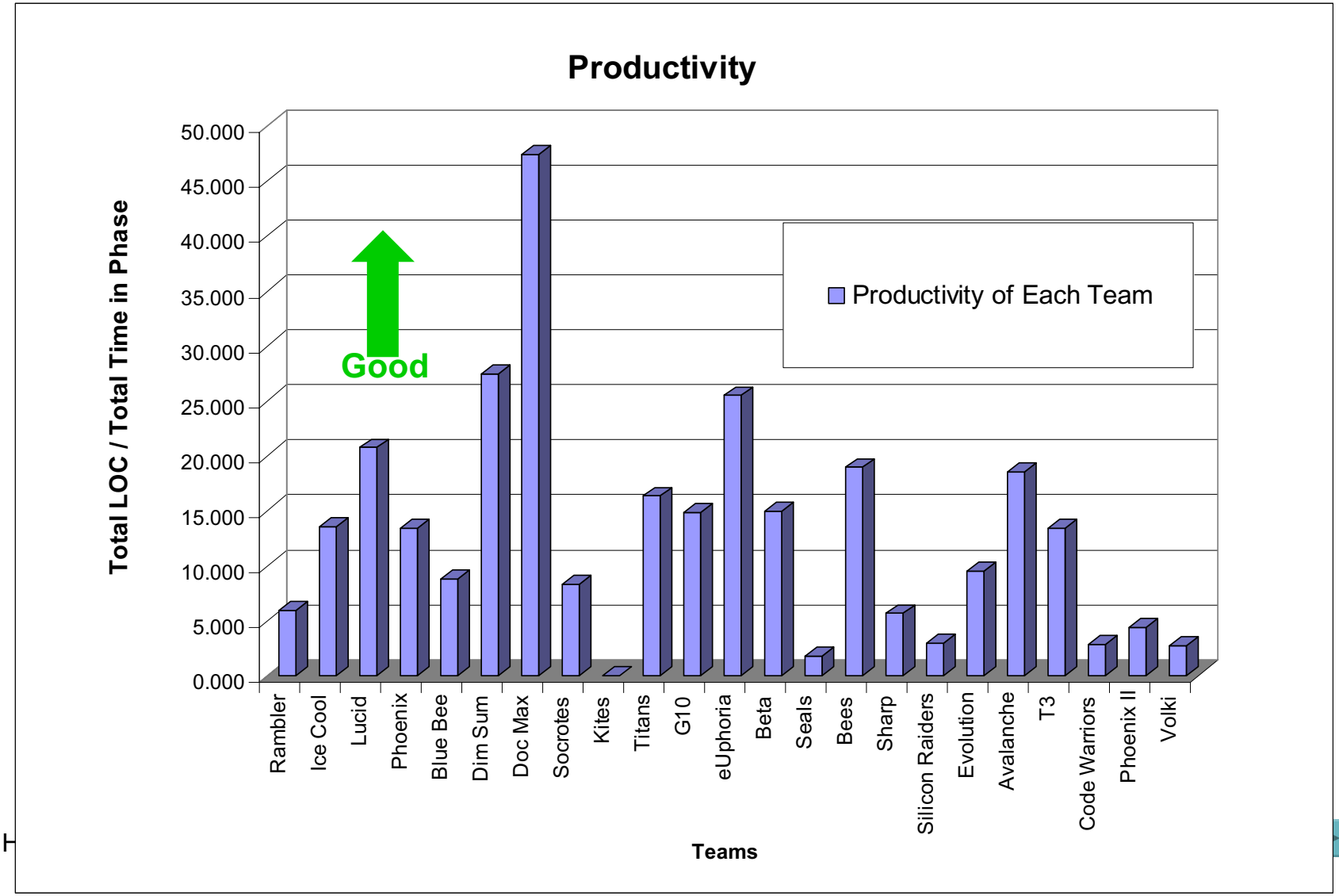

# How is TSPi used in the classroom?

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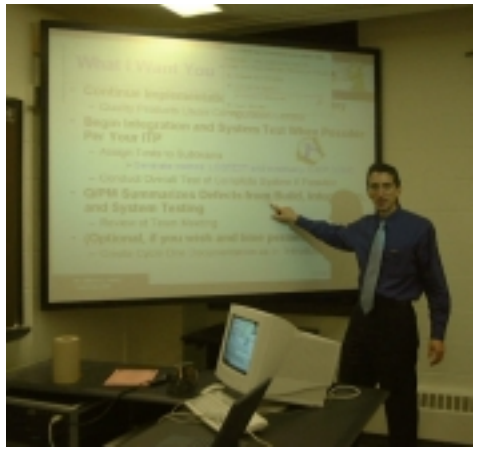
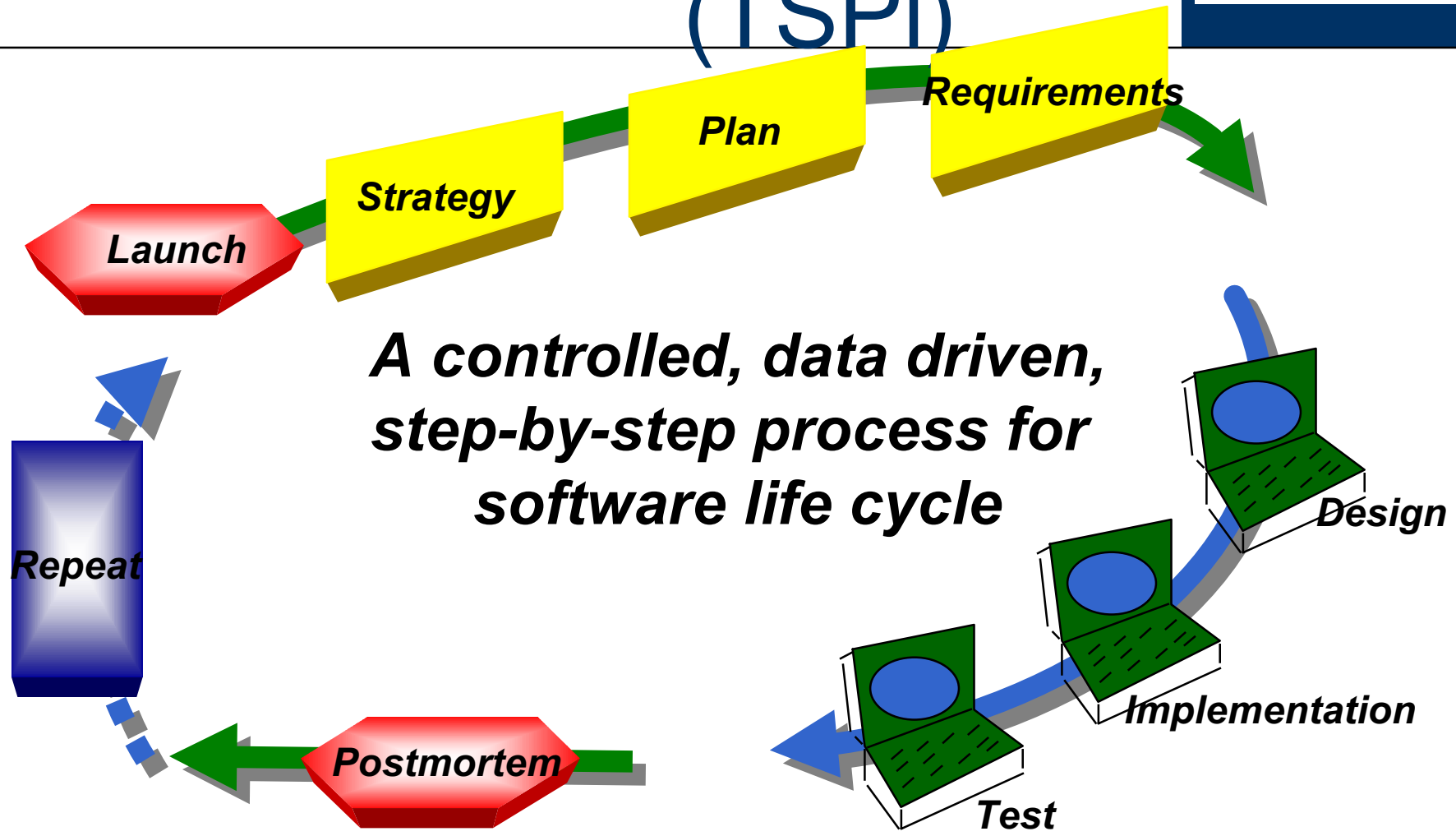


- Student teams complete two cycles of development
  - **Same team assignment for both cycles**
  - **Some switch roles for cycle two**
- "Customer" provides starting point
  - **Product Needs Statement (not full requirements)**
  - **2 to 4 meetings with customer to clarify needs and review requirements and plans**
- Teams present key milestones and demonstrate product to faculty, research assistants, customer

# The Process at a Glance (TSPi)




***A controlled, data driven, step-by-step process for software life cycle***

# How do students learn PSP first?

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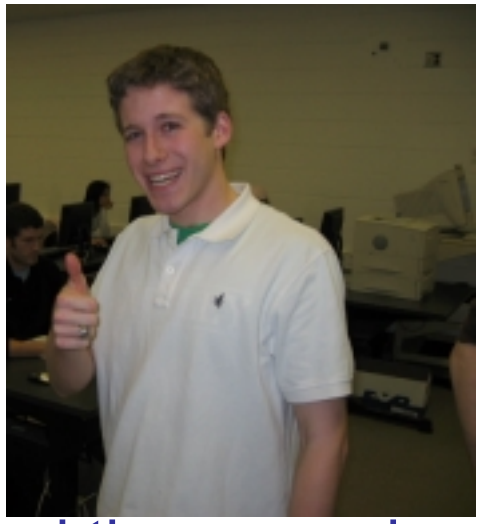

- Personal Software Process (PSP)
  - Required for individuals
  - Prerequisite for TSPi
- PSP trial introduction
  - Undergraduate programming course
  - Plan (estimate time), track defects, record time spend
- Only some TSPi student teams have this experience before TSPi begin
  - Quick two day introduction
  - One programming project

# Development Projects

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Titans
Fall 2002

- "Real World" Development
  - **University staff groups as custome**
    - **working system or,**
    - **prototype or,**
    - **requirements clarification,…**
- Wide range of applications
  - **Prospect tracking for Graduate School**
  - **Summer visit registration for College of Arts and Sciences**
  - **Student Portal for Information Technology**
  - **Grant Approval and Tracking for VP Research**
- Many technologies
  - C++, Java, XML, ColdFusion, …

# How are data collected?

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- Textbook: Watts S. Humphrey, *Introduction to the Team Software Process*[sm]
- Key data entered weekly into 21 forms:
  - **Product Summary (SUMP)**
  - **Quality Summary (SUMQ)**
  - **Work Tasks/Effort (TASK)**
  - **Schedule and Earned Value (SCHEDULE)**
  - **Defect Identification and Correction (LOG**
  - **Inspection Reports (INS)**
  - **Time Recording Log (LOGT)**

Phoenix

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## TSPi Plan Summary: Form SUMP

Name _____ Date _____
Team _____ Instructor _____
Part/Level _____ Cycle _____

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| Product Size | Plan | Actual |
|---|---|---|
| Requirements pages (SRS) | | |
| Other text pages | | |
| High-level design pages (SDS) | | |
| Detailed design lines | | |
| Base LOC (B) (measured) | | |
| Deleted LOC (D) | (Estimated) | (Counted) |
| Modified LOC (M) | (Estimated) | (Counted) |
| Added LOC (A) | (N-M) | (T-B+D-R) |
| Reused LOC (R) | (Estimated) | (Counted) |
| Total New and Changed LOC (N) | (Estimated) | (A+M) |
| Total LOC (T) | (N+B-M-D+R) | (Measured) |
| Total New Reuse LOC | | |
| Estimated Object LOC (E) | | |
| Upper Prediction Interval (70%) | | |
| Lower Prediction Interval (70%) | | |

| Time in Phase (hours) | Plan | Actual | Actual % |
|---|---|---|---|
| Management and miscellaneous | | | |
| Launch | | | |
| Strategy and planning | | | |
| Requirements | | | |
| System test plan | | | |
| Requirements inspection | | | |
| High-level design | | | |
| Integration test plan | | | |
| High-level design inspection | | | |
| Implementation planning | | | |
| Detailed design | | | |
| Detailed design review | | | |
| Test development | | | |
| Detailed design inspection | | | |

**If it's not documented, it's not there…**

**If you can't measure it, it's not there…**

# What Results?
## Defects Injected per LOC

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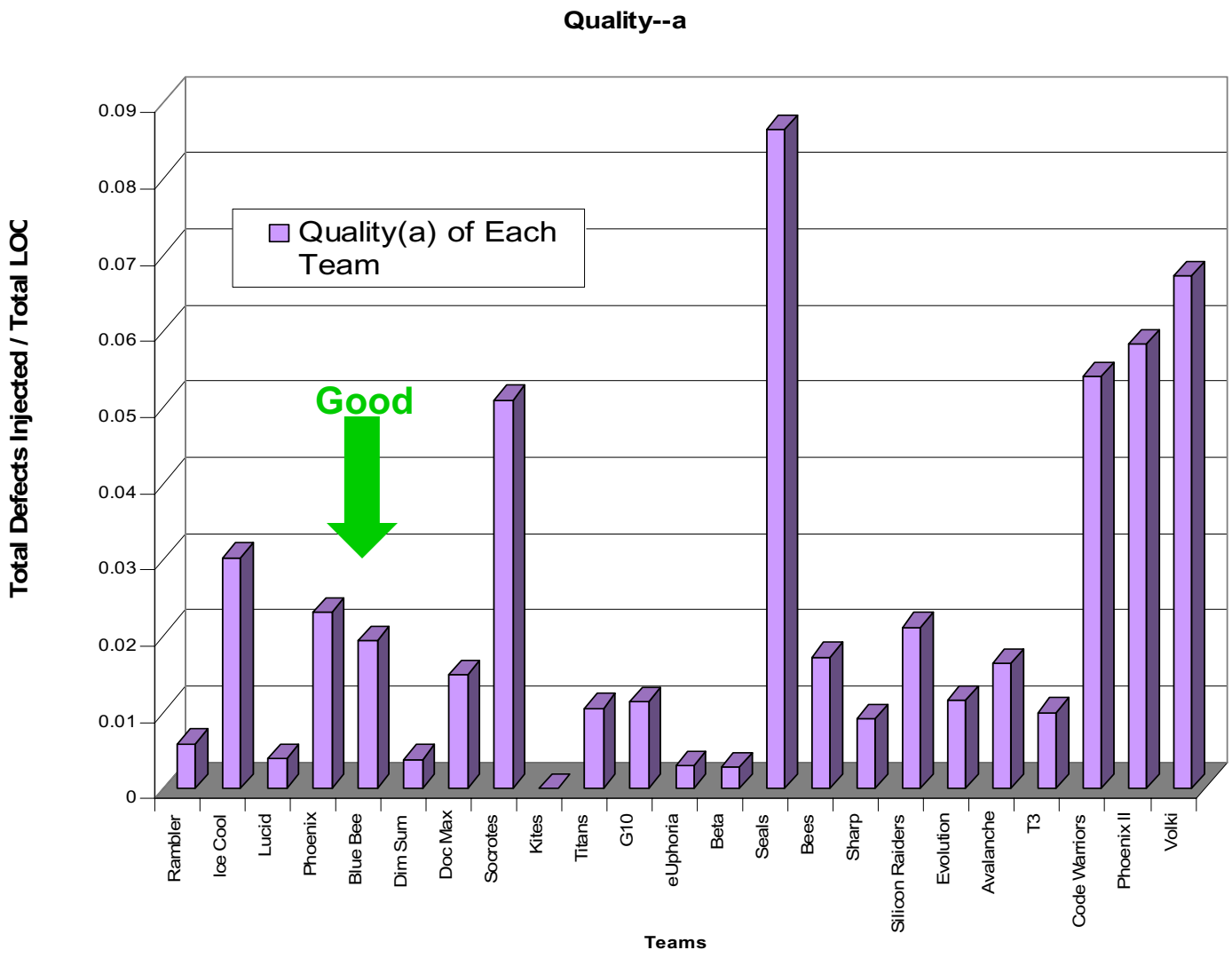

# Quality Results from Cycle Testing ONLY


- In Cycle Testing determines the quality numbers
  - No “production” use recorded
- “Testing can only show the presence of bugs, not their absence”
  - Fault Seeding
  - Bug Density / Arrival Rate Analysis

# Where are the Hours Used?
## Total Time by Phase

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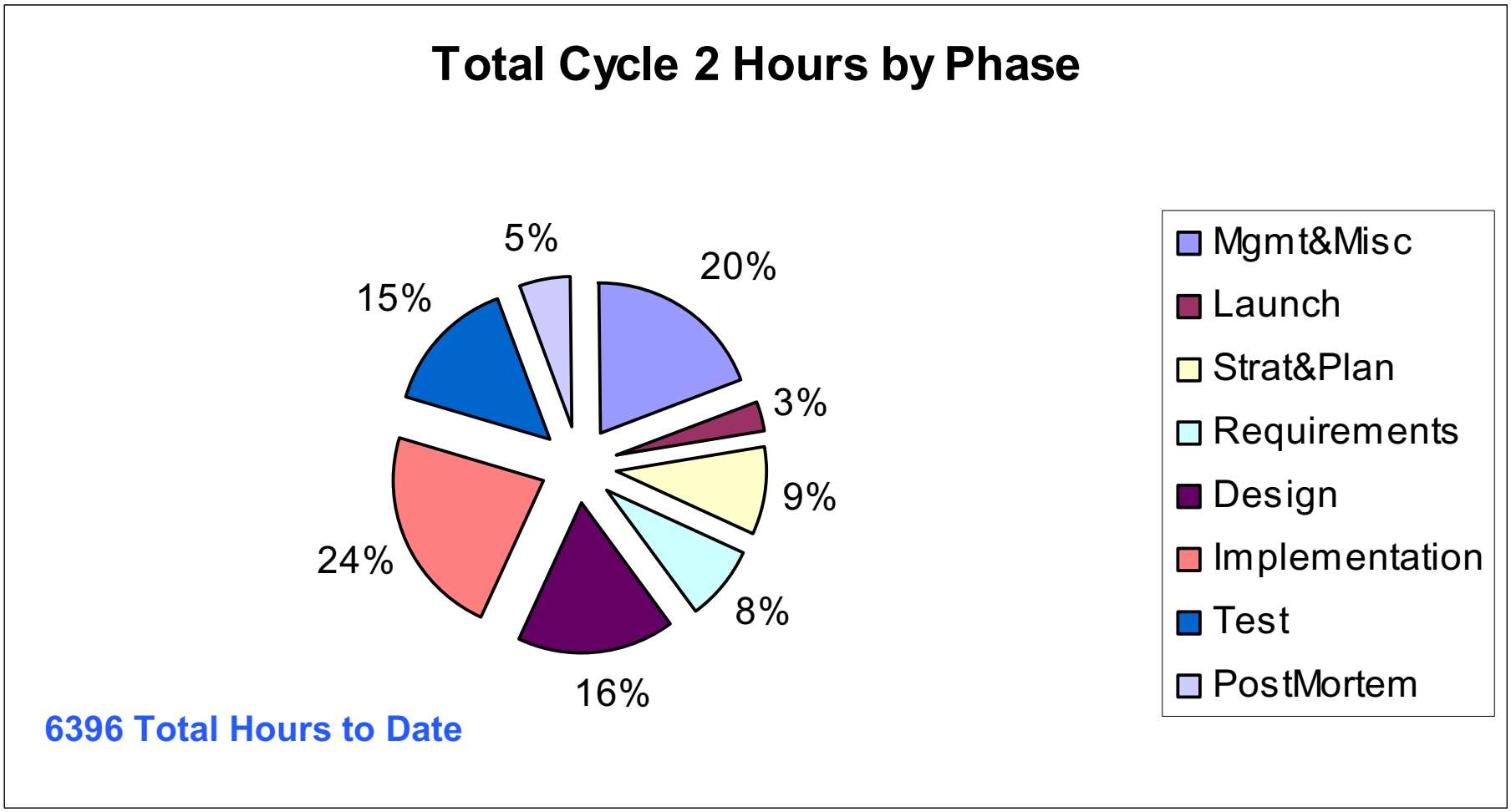

# Student Outcomes

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- Student Perceptions – Popular Course
  - **Team work experiences very positive learning**
  - **Understand process – appreciation varies**
  - **Data collection a struggle**
    - **Volume of data needed**
    - **Needed for timely team cooperation**

Volki
Spring 2005
Pot Luck

- My Viewpoint
  - **Students well equipped to join industrial teams; larger team sizes work well**
  - **TSPi textbook is great on metrics and quality, limited on coverage of design, testing,…**
  - **Volume of "paper work" can lead to cybercrud**

# Students "Value" Forms

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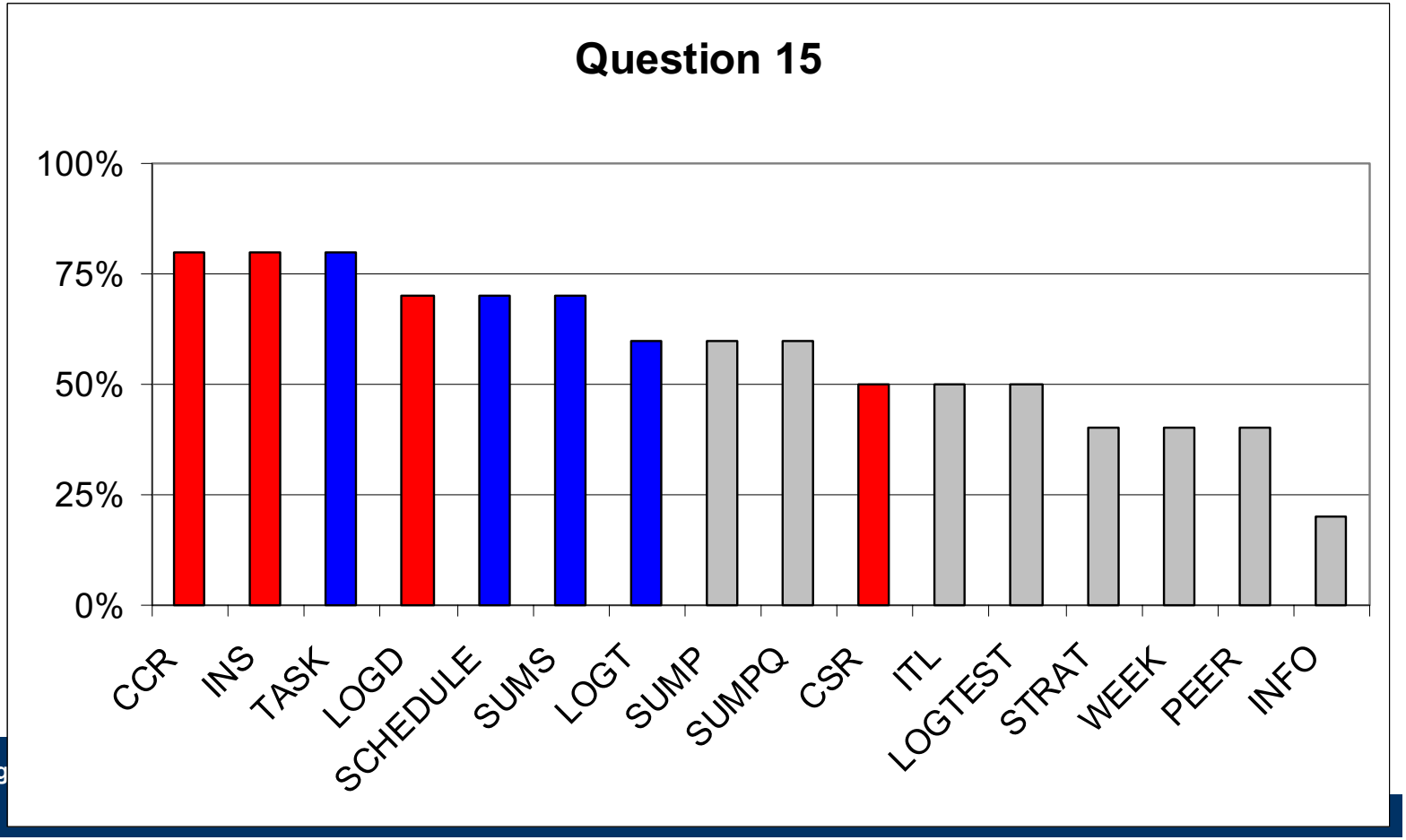
**Greatest perceived value in forms that manage change and defects (red) and project plan creation and tracking (blue)**

**Student Survey:** Choose the forms useful to your team.



# How do these findings apply to industry?

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- Student teams approximate small industry task teams / development groups
  - **Importance of (self) policing team behavior**
  - **Specialized roles help (in addition to developer role)**
- Training / Coach / Observer role is critical to rapid introduction of process such as TSPi
  - **Get through one cycle quickly to speed learning**
  - **Need Process Coach / Facilitator**
- Face to face regular meetings
  - **Weekly cycle of data, analysis, action**
  - **Emphasis on analysis and quality is key**
    - **Lead teams to analysis (not just data generation)**
- Historical data a real help for getting started
  - **If none, BEGIN NOW!**



# What about TSPi and Small Teams?

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- Team data for 23 student teams show industry level productivity early in learning TSPi
  - Quality *always* needs focus
- TSPi can be learned efficiently and applied rapidly
  - Team composition and coaching
- The "academic" learning approach likely applicable to other types of organizations
  - Value of discipline, data collection, metrics

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# LOC Vary Greatly

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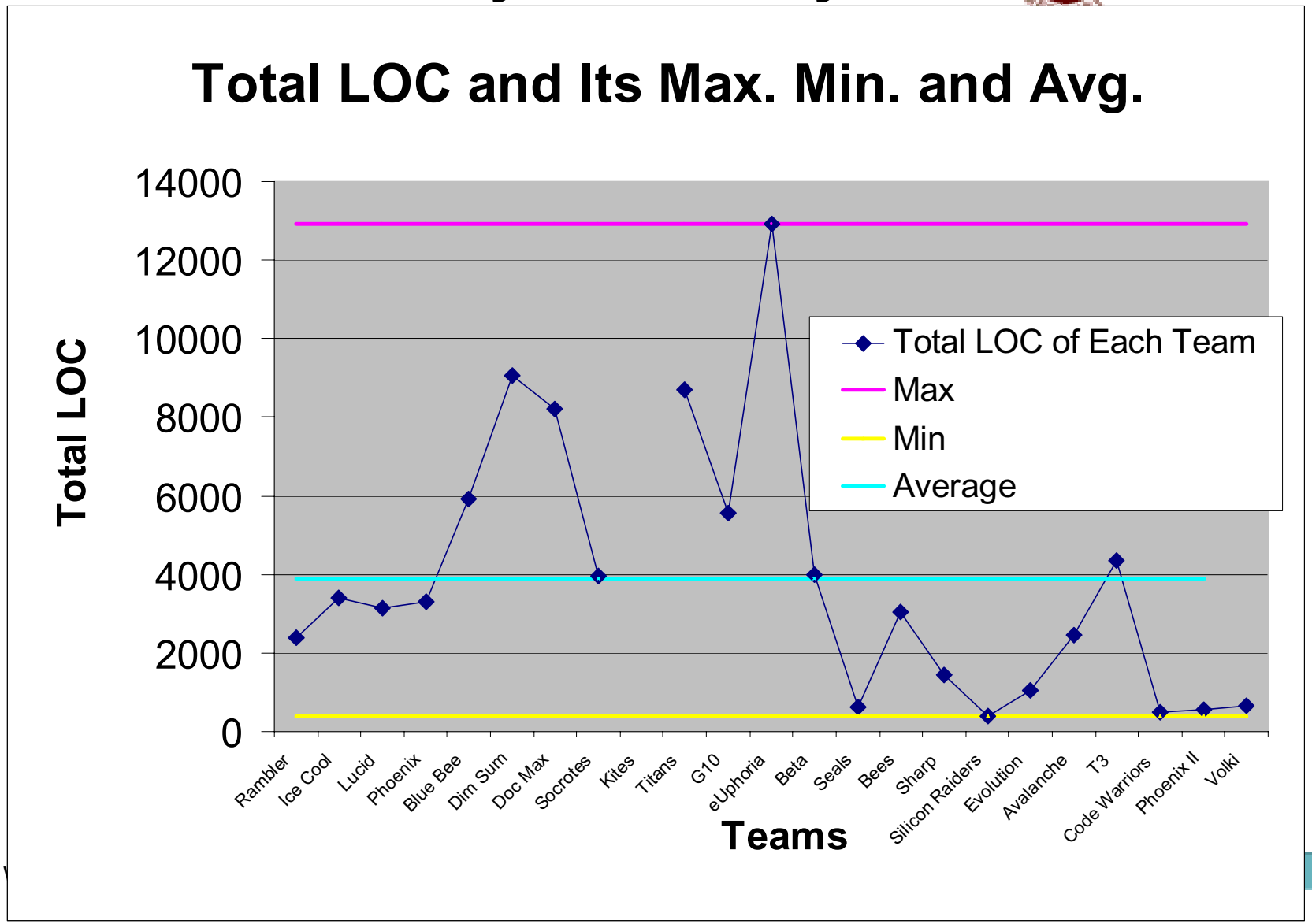

# Ramblers Team Metric Chart

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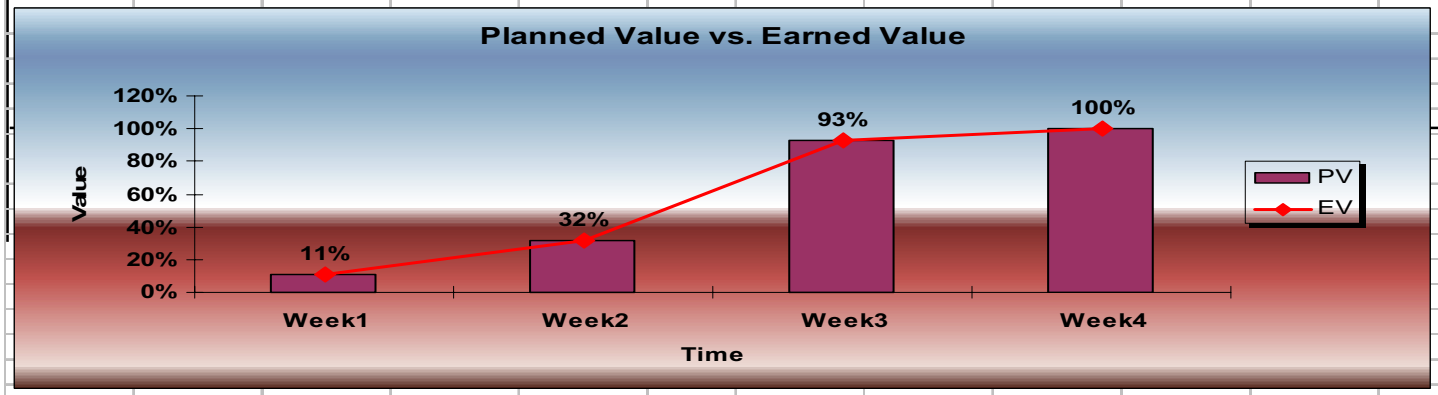
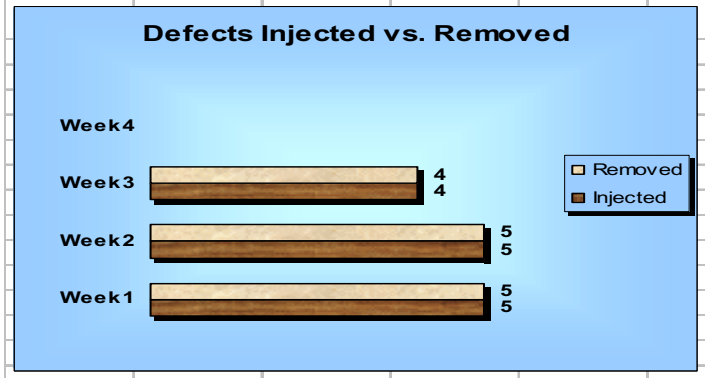
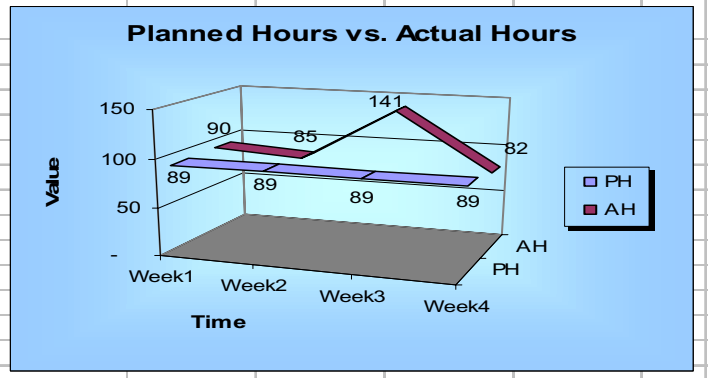
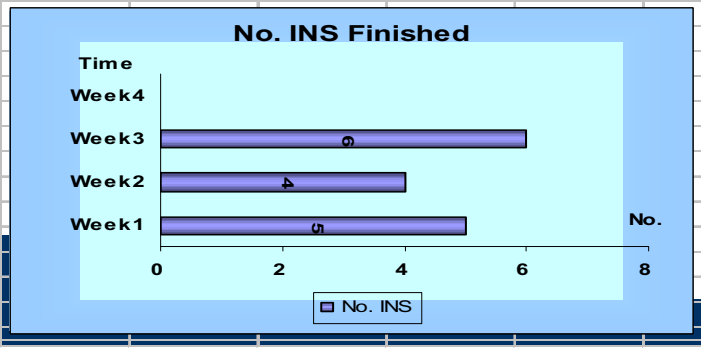
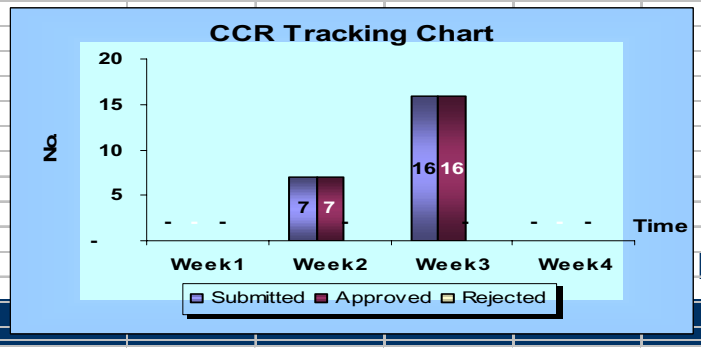


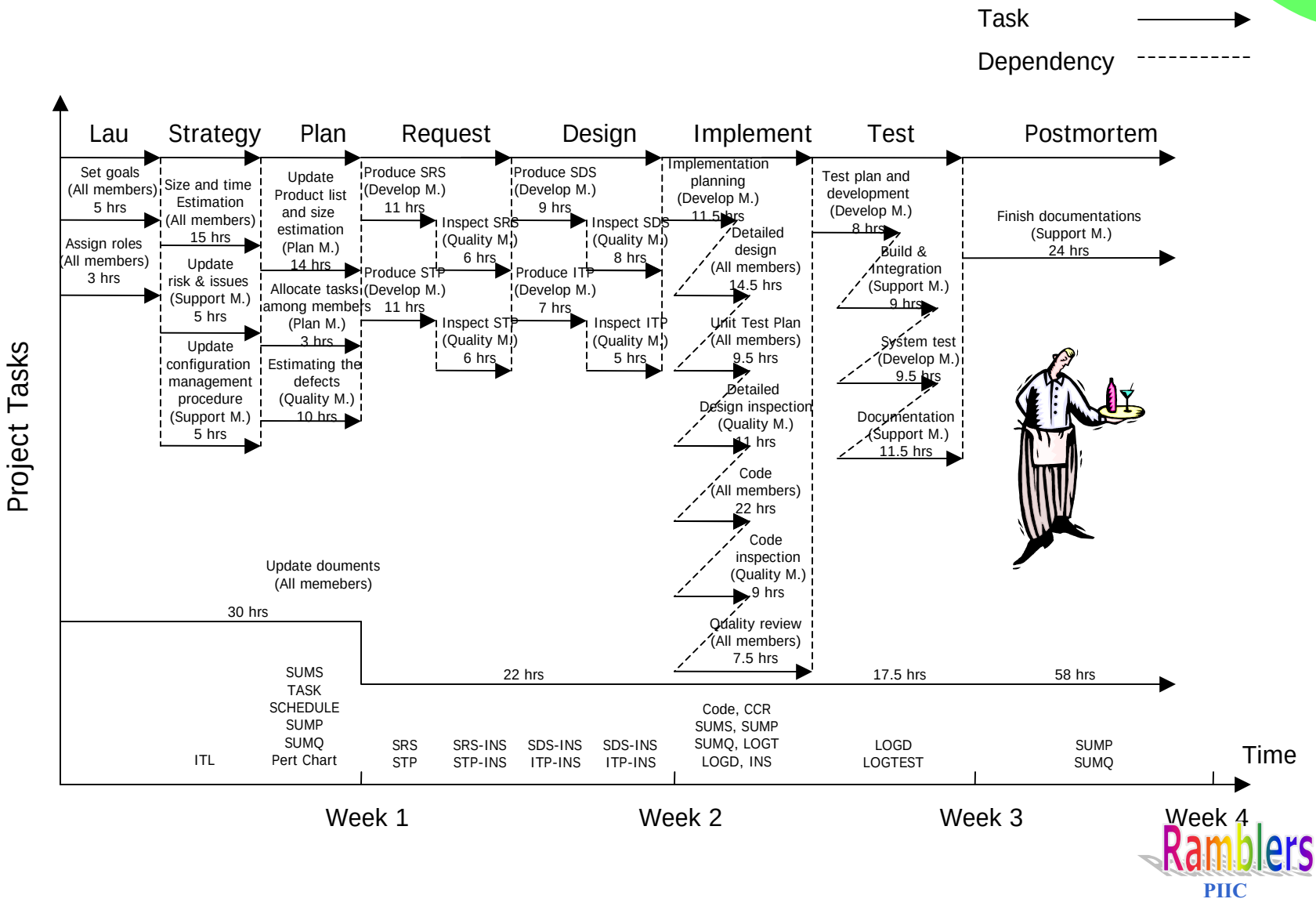




5-Up Chart

Findings, FEB 2002

# Pert Chart

CYCLE 2




Ramblers
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# Larger Team Size Works

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- Flexibility in Roles:
  - Some ability to switch roles
  - Easier to recover from “drop outs”
- Student Feedback:
  - Students identified the problems their team encountered
  - 20% felt a smaller team size of 5 would lessen the problems

# What are some next steps?

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**Expand Focus on Analysis Metrics for In cycle Quality Improvement**

**Ease Data Gathering Travail Mobile Tool**

**Incorporate Teaching Materials on Technique Best Practices**

**Effectiveness of TSPi to Accelerate Transition to CMMI**

**Questions, follow-ups, ideas…. contact**

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