



Experiences in assessing industrial based projects

- working with clients in teaching real life software engineering

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Murder in Doncaster!

- Last month someone was murdered in the town.
- On returning from the scene of the crime the first thing the detectives did was to consult DOMINIC

What is DOMINIC?



Most murders are related to Domestic violence incidents.

DOMINIC is the Doncaster Police's dedicated Domestic Violence Information System, it contains all known records of incidents in the area.

There are over 6000 such incidents each year.



DOMINIC contains details of victims as well as 'villains'.

National databases only feature the villains.

Victim support is a vital aspect of police work and an integrated system was needed.

Initially a commercial software house was contracted to build DOMINIC.



Although full payment was made no software was ever supplied.

Now, however, DOMINIC is up and running,
it was installed in July 2003,
it contains many thousands of incidents,
it is used daily
and it has never crashed.

It is a vital resource for the police and support agencies and NGOs involved in victim support.



Dominic was built by 2nd year students at the University of Sheffield as part of their course.

It is an example of the REAL software engineering that we carry out.

I will talk about the parts of our curriculum that involve such real/industrial group projects and how they are assessed.



We have three main activities of this type which are part of the:

Sheffield Software Observatory.

This is an essential part of our research facility in Empirical Software Engineering as well as a core part of our teaching program.



Software Hut Solutions

All 2nd year students are involved in this.

Teams are formed of between 4 – 6 students.

3 or 4 external clients are found.

Each client works with 4 - 6 different teams.

The teams compete to build the best solution.

The exercise lasts from February to June.

Students spend 15 hours per week on their project.



Software Hut clients

This exercise has run for the past 14 years.

- 2003. Doncaster Police
 Pharmacovigilance
 Control Instrumentation simulator

- 2004. Dating Agency
 Fizzilink
 Debt collection agent planner



Software Hut

All are REAL projects with REAL clients.

Good requirements capture is key.

We cannot imitate the clients or fabricate their businesses.

The clients are very serious about the exercise.

High quality systems **MUST** be produced.

Solutions have to contain full documentation for users and maintenance.



Maxi Project

This is a similar exercise with Conversion MSc students. Introduced and managed by Stan Price for 16 years. Students are novice programmers doing a very intensive Software Engineering degree. The projects are REAL with REAL clients. Most clients are academics from other parts of the University.



Genesys Solutions

A real, commercial software house run by advanced masters students.

4th year MEng. and Advanced MSc.

Typically 40-50 personnel.

Own business premises and independent network and equipment – mainly open source based.

15 hours per week on this activity.

Professionalism stressed – coding standards, high quality processes, latest agile technologies used.



The company operates almost exactly like a real one.

Real commercial projects are carried out.

The students have a major responsibility for the running of the company, decision taking, project management etc.

We, the tutors, act as advisers only.

It is run as a business.

We aim to make a profit each year.

We do training as well as software development.



Genesys clients

Cancer Research Campaign (CancerUK)

HDSports(skateskart.com)

MEDILINK

IBM etc.

Text4offers.com

i-Sky

IBM (Eclipse innovation grant)

Wilen, etc.



Genesys

Genesys has been running for over 8 years.

Most years there are between 40 and 50 members.

Although they are only working 1/3rd time in the company it still exhibits most of the issues to be found in many SMEs.

Several companies have 'spun out' eg. HDLifestyle

We have invested in company infrastructure, tools and processes extensively.



Our reputation for quality is very high.
The entire work force changes in September – this emphasise many important things about project management, organisation and documentation!

Last year one of Genesys' clients set up a new company, HDLifestyle, to market and further develop the system they built. It employs 5 of the former Genesys students who worked on the project.



Organisation

There is a Research and Development group and a Marketing group as well as specific project teams.

R&D is divided into Systems admin (who are responsible for running the network infrastructure and all equipment); Project support - who are attached to each external project and provide QA and tool support; Eclipse team who are developing open source plug-ins for the Eclipse environment eg. the ADEPT system developed by Genesys for XP.



Processes common to all these projects

For each project the teams have to produce weekly:
timesheets – Genesys has a card swipe in their premises which does this automatically,
minutes of meeting, requirements specifications,
designs,
test sets etc.

These form a unique archive which can be analysed in depth.



Data collection

Software Hut teams have to submit, continuously, their work through a CVS style bespoke management tool.

This tool supports both traditional and agile development methods.

We can use the tool to analyse many things – a particular interest is in requirements change and how it impacts on the project life cycle - and how such change can be managed.



The activities emphasise:

- solving real commercial and industrial problems;
- professional standards of practice;
- responsibility for managing clients and projects;
- involvement in the planning and strategic development of the company;
- developing core skills in context - mathematics, IT and technical literacy;
- gaining confidence in teamwork, communication skills, planning and negotiation – particularly in terms



of work loads within the team;
learning from their mistakes;
understanding business contexts and financial budgets;
developing the research agenda in design and consultancy;
providing focused, high quality, cost effective strategic support for SMEs and NGOs;
marketing their skills and knowledge.



Making company decisions,
Developing their own process,
Learning about business,
Taking control and responsibility.

Win, win, win, win!

Students, clients, University, research



Summons to the Secretary of State for Education



To brief him on Genesys at his request following my article in the Royal Academy of Engineering journal.

His view: "An excellent idea - why don't all universities do something like this?"

My reply - risk aversion - fear of Teaching Quality Bureaucrats.



Assessment issues.

The key principle is to identify the skills and know,edge that these programmes are trying to develop and address these.

All assessment is continuous - there are no exams.
Assessment is based on the production of artefacts and the continuous observation by tutors of the project teams.



This is not a cheap way of doing things.

Thus for Genesys 3 staff are involved for about a day per week on monitoring and managing the company - each student is also given at least 1 viva (30 mins)

The Software Hut requires 3 or 4 tutors for half a day per week (over 1 semester)

Maxi requires one external project manager for one full day per week (over 2 semesters)



Examples of assessment processes.

Software Hut

50% is awarded by the client for the final product

50% is awarded by the tutors for the process.

We identify the key issues with the client and provide them with a simple mark sheet and they are given 2 weeks to evaluate all the software delivered - usually between 4 and 6 different solutions.

They keep the best and award a prize to that team.



Marking scheme (depends on methodology used - design led or XP)

Tutor's mark sheet

Group number

A) Requirements Documentation (end of week 5)

A set of user stories.

A statement of requirements, signed off by the client [5 marks]

B) A detailed design for the proposed system, using an appropriate language. [10 marks]

Comments.

C). Completed test results and acceptance test report. [10 marks]

Comments.



D) Complete code listing, this must satisfy the coding standards (where appropriate) together with full documentation [10 marks]
Comments

E) User documentation containing: [5 marks]
installation instructions
maintenance guide/ manual
Comments.

F) A commentary on the project, (maximum 10 sides) containing: [10 marks]

A log of the project describing important milestones

A description of the group structure, the roles of individuals and mechanisms for communication used between group members.

A description of the quality control strategy, who did what, when and how the acceptance criteria were defined.

A list of any references to the literature used during the project.



An evaluation of the group performance including an allocation of the proportional effort contributed to the project by individuals in the group. This statement must be signed by all members of the group. Evidence of pair programming.

In addition to the commentary, please supply copies of all team meeting minutes, showing responsibilities for actions, progress made and revisions to the project plan.

Comments.

Total process mark. [50 marks]

This mark is combined with the client's mark which is also out of 50 marks.



Clients mark sheet

(Marking scheme subject to negotiation and agreement with clients.)

Documentation -

Presentation *5 marks*

User Manual *5 marks*

Installation guide *5 marks*

Software system -

Ease of use *5 marks*

Error handling *5 marks*



Understandability (use of appropriate language, etc.) *5 marks*

Base Functionality (completeness) *5 marks*

Innovation (extra features) *5 marks*

Robustness (correctness - doesn't crash) *5 marks*

Happiness with product *5 marks*

Software Hut Clients' sheet. *total 50 marks*



Genesys

The key criteria is concerned with success in achieving the company's business objectives.

Each student has a different role in the company and so we need a flexible scheme to deal with this.

Each student fills out a self assessment form and writes a review of their progress each month.



Genesys Solutions' Students Self Assessment

Individual Qualities and Achievements:

Evidence of leadership skills	1	2	3	4	5
Evidence of working towards team and company goals	1	2	3	4	5
Evidence of planning and organisational ability	1	2	3	4	5
Evidence of involvement in quality control activities	1	2	3	4	5
Evidence of technical achievement (relative to abilities at start of course)	1	2	3	4	5
Evidence of skills in customer liaison	1	2	3	4	5



Evidence of skills in document production and management 1 2 3 4 5

Team Qualities and Achievements:

Planning Effectiveness 1 2 3 4 5

Requirements Elicitation 1 2 3 4 5

Specification and Analysis 1 2 3 4 5

Design and Implementation 1 2 3 4 5

Testing and Quality Strategy 1 2 3 4 5

Individual Grade: __/ 35

Team Grade: __/25 (__)

Total: __/60



We interview each student individually and consider their self assessment along with the other evidence:

Minutes of meeting, these are collected weekly.

Time sheets, these are collected weekly.

Monthly reports dealing with the individual projects and a system administration report and occasional Research & Development reports.

Information and questionnaires from clients together with client interviews, where possible.

Project data - requirements, stories, test sets, code, QA reports etc.



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For further information about the software observatory
see -

<http://www.dcs.shef.ac.uk/vt/projects/softwareobservatory.html>

For information about Genesys see -

<http://www.genesys.shef.ac.uk>