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PROJECT CASE STUDY

Project Title:

Introducing a 'Forensic Flavour' to the teaching of databases.

Project Team

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Abstract:

Databases often receive an uninspired and uninterested response. The curriculum content of a database module generally involves the design of entity-relationship models, SQL programming, application development and advanced database applications such as data warehousing and data mining. These are often taught within the tired and relatively worn case studies of purchase order systems, retail or health care systems. However the current trend for crime scene investigation drama and the frequent stories in the news of personal tragedies involving incorrect data, missing data or data mix-up capture the attention of many. The truth is that crimes require data investigation and expert database witnesses to provide evidence and this requires database knowledge and skill.

This project involved the introduction of a 'forensic flavour' to the teaching of databases as part of an undergraduate Computing Degree to students. The 'forensic flavour' involved introducing investigative and enquiry based learning techniques as well as selecting case studies based around real-life crimes and crime data. The learning objectives remained unchanged for the modules as did the curriculum content. The initial findings are that the students engaged on average 40% better and enjoyed the experience more.

Project aims:

The objectives of the project were:

- To improve students learning by inspiring students with the importance of data, databases;
- To improve students confidence, risk taking, investigation, problem solving skills by introducing self-lead enquiry based learning;
- To improve the general perception of databases.

Initial interviews were held with database experts and the Police in order to identify situations where 1) Data had provided key evidence in a case. 2) The database had provided key evidence in a crime or 3) Data anomalies had led to serious issues. This process raised a number of interesting cases such as the Harold Shipman case and common company frauds (eg fraudulent expenses).

The material for level 5 and level 6 databases was reviewed with a view to creating 'Enquiry based Learning' activities or activities involving problem solving or investigative activities. Module case studies in the field of crime or law were identified. Much of the database material was reworked to incorporate the case studies or use 'investigative' learning activities.

The module was delivered to meet the same learning outcomes but using the newly developed material.

Outputs

A number of new learning activities were created including:

Workshop on 'Horrendous data stories' – students were asked to report on a story where the wrong or missing data had had significant consequences. Stories reported included a girl who died due to being given the wrong blood type in a transfusion, a man who has been

wrongly arrested a number of times, missing SATs results, utility companies who didn't send out bills for 6 months.

Bug fixing – students were given SQL code containing common errors to fix.

Data Analysis – students were given database tables containing data anomalies to discover.

Data Mining – students were given UK crime data to analyse and look for patterns.

Data Dictionary – students were asked to prove suggested anomalies using the database data dictionary.

Assignments were created for both levels based around real UK data.

Two L6 projects were created and have been taken on by students:

1. "Investigation Required"

This project is to create a 'case study' of a system where a fraud has occurred.

Part of the project is to investigate and report on common frauds. Some examples are:

- The rounding error fraud;
- Payments made against 'dead' project codes;
- Payments made to people after they have left the company;
- Purchases against equipment that hasn't been acquired.
- Employees making purchases, expenses claim for their own benefit;
- Identity theft;

The aim of this case study is to use it within teaching (databases, forensics) for students.

They will be asked to act as an expert witness and produce a report of evidence to support the charge of fraud.

It is envisaged this project will be developed in Oracle Apex. Other possible considerations are:

- The use of multiple log-ons (to demonstrate how some personnel have access to certain information);
- The importance of the database 'metadata', only available to the DBA to show when data was updated, when users logged on and what they accessed.

2. DBA Consultancy

This project is to create a 'case study' of a system which is performing badly. The aim of this case study is to use it within database teaching for students. They will be asked to act as a Database Administrator (DBA) and produce a report of recommendations to improve the system using appropriate techniques. Examples to include in the system are:

- Concurrency problems (users are locked out, dead lock)
- Slow running queries, which can be evidenced and investigated using QEPs. (such as a cart-prod followed by a SELECT distinct);
- Examples of redundant data, inconsistent data as a result of de-normalisation;
- Examples of slow running queries where de-normalisation would help;
- Examples of out of date indexing plans;
- Examples of insecure systems (security put in client, SQL injection);
- Examples of default setting that lack consideration (logging, audits, indexes).

It is envisaged this project will be developed in Oracle Apex.

Both these projects received much initial interest and have been taken up by students as final year projects. They are to be completed in June 2010 and the intention is to use them in L6 teaching.

The team have two papers under construction on the project. Abstracts have been accepted to the ATINER and TLAD conferences.

Impact

The staff involved in the have enjoyed learning about the Forensic industry. Students appear to have been genuinely motivated and enthused by many of the activities.

Additionally it appears that the project has widened the horizons of databases, some of the developed content has been used with Sports Marketing and Business students – both groups who seemed to appreciate the value and importance of data as a result. At Enterprise events delegates have volunteered their own 'data-mix-up' stories, again suggesting that you don't have to be an expert to appreciate the significant of quality data!

Evaluation

Students on both L5 and L6 modules were surveyed before the modules (L5 database Application Development and L6 Advanced Database Management). They were asked which skills they thought they would be developing and given the options to strongly agree, agree, disagree, strongly disagree or neither agree nor disagree. The skills surveyed were grouped into: Technical skills (SQL, database design), investigative skills (data integrity, data analysis) and Enterprise skills (problem solving, personal time management, researching and scoping a problem, communicating ideas, confidence, risk taking).

Students were surveyed again on completion of the modules and asked to evaluate whether they thought they had developed the skills, again given the same options.

The findings are still being evaluated The initial findings are that the students engaged on average 40% better and enjoyed the experience more.

What Next?

The team intends to continue to consider enquiry based learning and problem based solving. Some more learning material along similar lines is planned for 2010/11.

Some useful contacts have been made in the field of forensics which we will continue to develop.

General Conclusions

Even though, it is difficult to measure learning (as discussed for example by Biggs, 1993), we can report that due to one or more likely, a combination of the factors implemented in the 2009/10 delivery the student experience was improved. Learning is a significant part of the student experience and the improved module feedback and student reflection, although not conclusive, does suggest an improved learning experience.

To conclude, the forensic flavour was appreciated by the students and it was felt by staff and students that there was a general interest in the application of crime based case studies to databases.

