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# MORE ON ORACLE APEX FOR TEACHING AND LEARNING

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## ABSTRACT

*TLAD08 included a paper by Tomlinson & Gardner on “Teaching Enterprise Database Application Development Using Oracle Application Express (APEX)”. APEX is essentially a web-based development tool for building web-based database applications. This paper aims to extend from the experiences of Tomlinson and Gardner by focussing on an evaluation of APEX in respect of: administration, scalability and reliability for teaching; teaching and learning of introductory database application development; promotion and monitoring of engagement and feedback of learning; teaching and learning of more advanced database application development. The paper concludes with an overall positive view in relation to these four criteria, and identifies areas of improvement for using APEX for teaching and learning.*

## Keywords

*Databases, Oracle Application Express, APEX, Web-based Database Applications.*

## 1. INTRODUCTION

Last July the proceedings of TLAD 08 arrived in the post at a timely moment. A glance through revealed a paper by Tomlinson & Gardner [1] on using APEX. We had just restructured our courses in the School, and this resulted in a revamped and enlarged “Introduction to Databases” 20 credit point unit at level 1. We had planned to continue to use Oracle – primarily iSQLPlus and Oracle Forms. However, this was an opportunity to perhaps use APEX instead.

Application Express (APEX) is essentially a free web-based development tool for building web-based database applications. Form, report, home and login pages with default functionality can be developed quickly using wizards, and these pages can be then developed into usable and accessible applications using PL/SQL, trigger and other established Oracle technology. Further information about APEX can be found at [2]. Our APEX installation is APEX 3.1 (3.2 latest version) on Oracle Database 10g.

This paper aims to extend from the experiences of Tomlinson and Gardner by focusing on an evaluation of APEX in respect of:

- Administration, Scalability and Reliability for Teaching
- Teaching and Learning of Introductory Database Application Development
- Promotion and Monitoring of Engagement and Feedback of Learning
- Teaching and Learning of more Advanced Database Application Development

## 2. CONTEXT

Our BIT, Computing and Networking programmes, comprising 12 BSc courses, were restructured and revalidated last year around shared and explicit themes. This included a 60 credit point databases theme starting with an Introduction to Databases unit at level 1. This unit was delivered to 150 students split into 9 groups (maximum 20) with 2 hours of mainly practical based class contact per week.

Readers are welcome to access this unit through our myCourse Moodle site at [mycourse.solent.ac.uk](http://mycourse.solent.ac.uk) using the username/password of **tlad/tlad**. The following in italics is part of the narrative for this unit written primarily for the student:

*Essentially, this level 1 unit is an introduction to developing a database application solution, in a methodical way, and using appropriate software tools. This should provide a sound grounding for those on Computing, Networking and BIT courses who will be taking the level 2 Database Application Development unit, and for those on other courses who need to know about databases, but may not necessarily be closely involved with*

developing them. The level 2 Developing for the Internet unit involves accessing databases, and so those on courses taking this internet unit should also find this databases unit helpful.

Essentially, the unit comprises 5 coherent themes enabling the deployment of a business application solution. You will develop elements of this application as you progress, and improve these elements in the light of feedback from your tutor and peers. The unit will conclude with integrating these elements into a deployed, presented and assessed application solution.

Developing database applications, like any other computer-based application, involves the key steps of analysing user requirements, and the consequent design, implementation and testing of the database and other application elements. This development should be undertaken in a methodical way (eg using 'agile' methods) and should involve the use of 'models' (eg a data model) to help in the development process.

We will not adhere strictly to any particular methodology, or any particular diagrammatic notation (such as UML), as this is an introductory unit on a diverse range of courses where methodologies are covered to a varying extent. However, we will focus on understanding the user requirement, and then designing, implementing and testing application elements that meet this requirement.

The narrative continues to describe each of the following 5 themes in more detail:

- Retrieving Data using SQL (5 weeks)
- Implementing Databases with Integrity using SQL (4 weeks)
- Developing Applications inc. Forms and Reports (5 weeks)
- Administering Database Applications and Databases (2 weeks)
- Deploying Applications to Users (2 weeks)

We decided to continue to use iSQLPlus (rather than potentially the SQL Workshop alternative in APEX) for the first two themes up to Christmas whilst we installed, implemented and tested the APEX environment.

### **3. ADMINISTRATION, SCALABILITY AND RELIABILITY FOR TEACHING**

It was important to ensure that APEX could be administered and used in an as effective and efficient manner as possible, and to ensure that both students and tutors were fully informed as to how this would be achieved. A guide "Administration of the University APEX Development Environment" was therefore written and is included without modification in the appendix to facilitate potential reuse by interested TLAD attendees or others.

Essentially, the core APEX structure used was the workspace, and each of the 9 classes was allocated a workspace. This overall approach did indeed prove convenient, effective and efficient with little or no difficulties. It took a few hours to design, implement and test, but should require relatively low maintenance in the future. However, it is important to emphasise that this is a shared class workspace rather than an individual student APEX workspace.

Another key decision was to map each workspace to the same Oracle supplied OEHR database (OE – Order Entry, HR – Human Resource). However, whilst this approach made it easier to control and maintain the table, sequence and other data objects the students were accessing, it offered less scope for students to implement and manage their own database objects. It was also necessary to monitor the database for, for example, inappropriate updates and primary key sequences exceeding maximum values. Students generally conformed well to the requirement (detailed in the guide) to restore any updates to the database, but in any case it only took a few seconds to recreate the original database.

Tomlinson & Gardner discussed the lack of scripting capability for setting up user accounts. However, the approach of getting the students to create their own accounts in class, under the supervision of the tutor, took only about 30 minutes for a full class of 20. Figure 1 shows developer (yellow), user (green) and administrator (red) users. Forgotten passwords and unsuccessful logins were handled in the class in real time – note the locked users and the users whose passwords had expired!

An important point to make here is that this shared approach fitted in with our teaching and learning strategy for the "Developing Applications" theme, but would be more problematic for the first two themes where individual student Oracle schema are required. Setting up 150 individual mappings of student to APEX workspace to underlying Oracle schema is likely to be a very time-consuming process! We discuss the implications of this at the end of the next section.



Figure 1 – View of the Users of one of the APEX Workspaces

Displaying APEX screens with overhead data projection proved to be a very useful teaching and monitoring aid throughout the course. This is discussed further in section 4.

We openly administered the workspaces during the class to expedite and facilitate use, and to develop their understanding of administration. This real time administration was therefore arguably effective and certainly efficient for all concerned. There were no issues that we could not resolve either directly or as a workaround, and in this respect APEX proved generally to be both scalable and reliable.

## 4. TEACHING AND LEARNING OF INTRODUCTORY DATABASE APPLICATION DEVELOPMENT

Essentially, after having taken into account the risks involved in introducing a new teaching tool, we set the pass (ie satisfactory) benchmark level comparable to being able to apply most of the functionality covered in the “2 Day + Application Express Developer’s Guide” [3]. In particular, this involved applying section “4 Building Your Application” including form, report, home and login pages. This is based on the Oracle supplied OEHR database.

More specifically, the students were required to develop an application which would enable HR users to view and manage locations (international company sites). This included:

- A report of the locations.
- A form which enables locations to be inserted, updated and deleted.
- A home page containing links to these report and form pages.

In order to discriminate this learning outcome, we established assessment criteria for satisfactory, good and excellent performance. Good performance, for example, required usability features to be added such as select lists, validation and relational links to other tables for additional descriptive fields.

We consider now the following measures to assist in evaluating APEX in this respect:

### Meeting the Requirement

As indicated in the appendix there are nine workspaces from BIT, Computing and Networking courses: BIT1 (Business Information Technology), BIT2, COMP (Computing), COMPSE (Software Engineering), Games1 (Computer Games Development), Games2, Games3, WDES (Web Design) and WDI1 (Web Design and Internet Technology). In the final stage of the unit, students deployed their application into a production workspace and demonstrated it to their peers in class under overall tutor supervision and using an “Application Functionality Check Sheet”. Based on the assessed criteria, we have checked each individual student’s deployed application and the analysed results are shown in Figure 2.

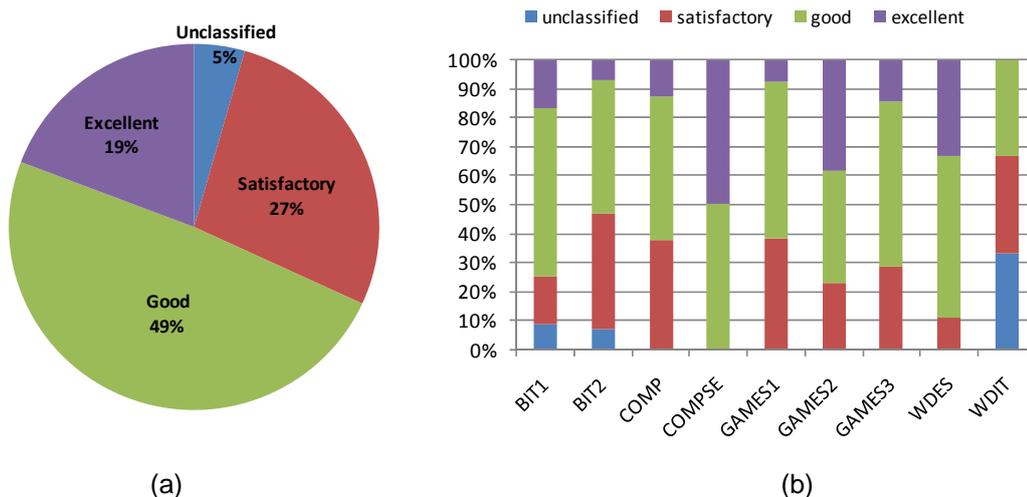


Figure 2 - Deployed APEX Application Assessment Results

90 out of 150 students (ie 60%) successfully deployed their assessed application and Figure 2(a) shows the overall distribution in four categories: unclassified, satisfactory, good and excellent. 27% of students who followed the basic “2-Day” guide achieved their task at a satisfactory level and nearly half of them met a good level. It is interesting to note that 19% of them took advantage of the Advanced Tutorials [2] and produced excellent work. Figure 2(b) provides a further analysis for individual workspaces. It should be noted that eventually 90% of the students successfully developed applications including those who did not actually deploy their application and those who submitted late.

### Average Time Taken

The monitoring facility (discussed in section 5) in APEX indicated that the average time spent by the student in APEX was approximately 20 hours. Although it is not known how much of this was meaningful engagement, it nevertheless seems a reasonable amount of student development time.

### Application Errors

The monitoring facility also provides a list of the Oracle errors (eg ORA-00900: invalid SQL statement) including the application, user and time context of the error. This proved useful in helping the tutor to efficiently identify and help students resolve common Oracle errors. None of the workspaces revealed an excessive number of errors.

Whilst recognising that this is by no means an indepth analysis, these measures do help collectively to support the suggestion that learners can develop APEX applications reasonably effectively and efficiently.

The more confident level 1 students (around 19%) were able to find out about and implement relatively more complex functionality and concepts such as APEX processes and session state. However, it was sometimes difficult to control/restrict less confident and weaker students getting into a context (often promoted by the use of wizards) which was difficult for them to handle, and arguably inappropriate for the tutors to try to explain and resolve for them. Virtually all the students were able to complete the “2-Day” tutorial. However, applying the concepts and skills embodied in the tutorial to the assessed application proved problematic for around 10% of the students. There is therefore probably a need for a further layer of structured activities to help these weaker students implement key functionality such as implementing a parameterised APEX SQL report.

In contrast to Oracle Forms, APEX is more “template/menu driven” in its approach, You cannot move field, text etc around in a design window as in Oracle Forms. This sometimes made it more difficult to achieve a specific layout design. The comparison to Oracle Forms is discussed further in the advanced database application development section 6.

In addition to the “2-Day” guide mentioned earlier, Oracle APEX provide adequate (in our view) online learning and teaching materials including a Developers’ Guide, Administration Guide and Advanced Tutorials [2]. Furthermore and on their own initiative, students also identified and recommended some books eg “Beginning Oracle Application Express” by Rick Greenwald [4].

A key issue however is that shared workspaces limits the individual development of schema objects. The implication of setting up individual workspaces (discussed in section 3) means that we will continue to use iSQLPlus next year for developing core skills in the “Retrieving Data using SQL” and “Implementing Databases with Integrity using SQL” themes. However, it appears that Oracle will only support the client-

based SQLDeveloper tool in the future rather than iSQLPlus, and so we now offer SQLDeveloper as an alternative.

## 5. PROMOTION AND MONITORING OF ENGAGEMENT AND FEEDBACK OF LEARNING

### Accessibility

A significant advantage of APEX, in comparison to Oracle Forms, particularly in our University IT environment, is the web-based accessibility from every IT area and classroom in the University. Previously, accessibility was severely limited and problematic because of the architecture of Oracle Forms and the need for client software. Next year, access from off-campus to the APEX server should also be enabled as has been the case for some years with iSQLPlus. This should further promote engagement with APEX.

### Application Window

The “View Applications” of a workspace screen in Figure 3, which shows the applications developed by the student (and example applications developed by the tutor and Oracle), was very useful throughout the classroom sessions for both monitoring and feedback.

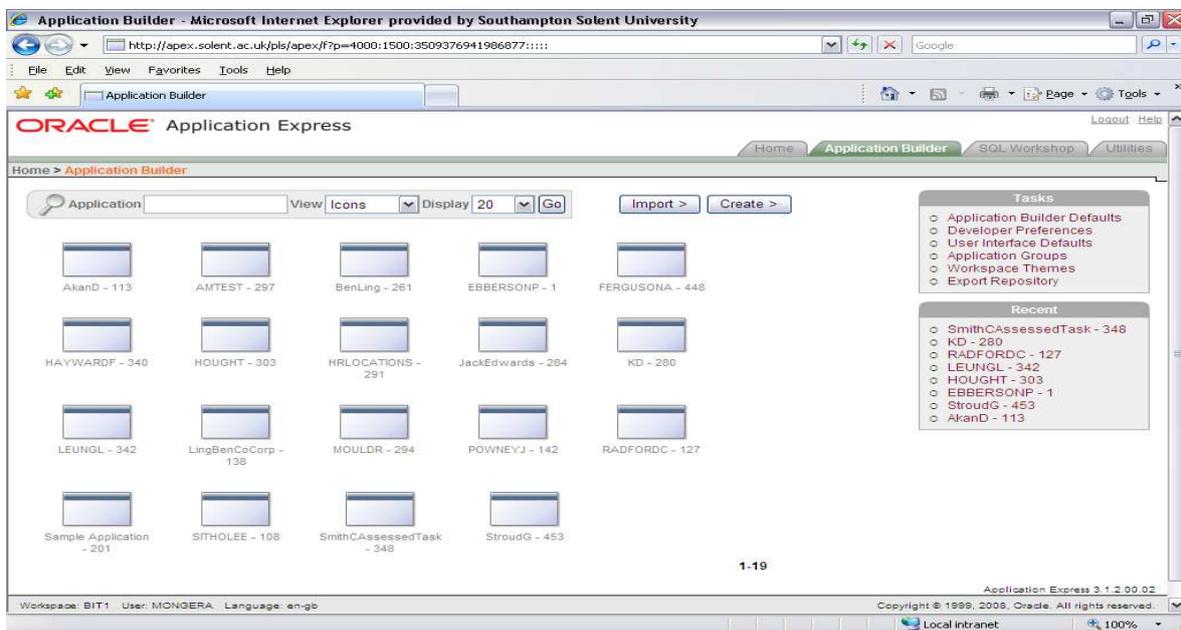


Figure 3 – View of the Applications of one of the APEX Workspaces

### Monitor Activity

The “Monitor Activity” facility in APEX provides a range of statistical information about the development of applications by users. For example, Figure 4 shows the “Page Views by User” of the previous workspace.

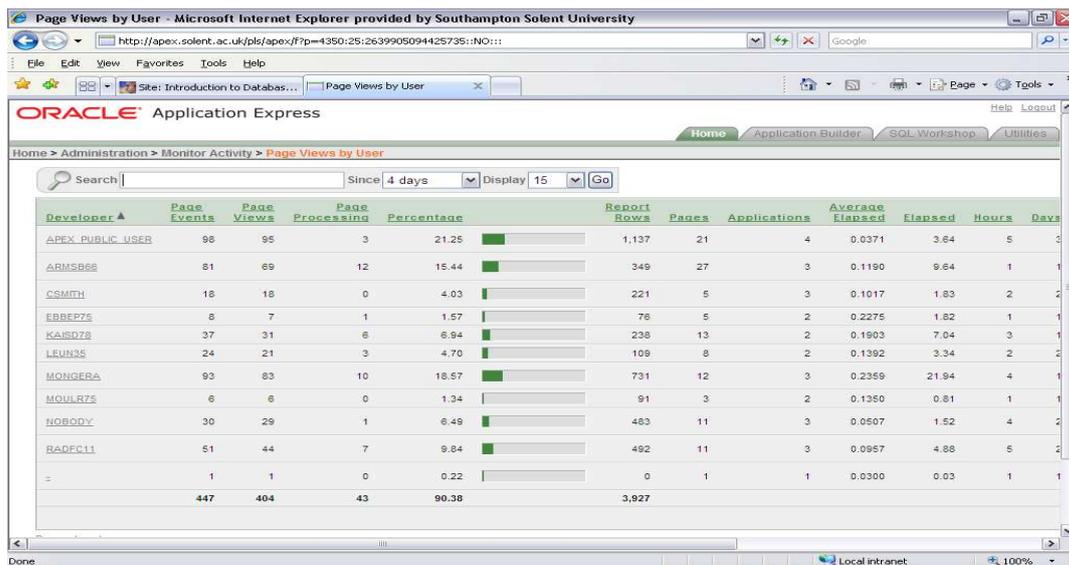


Figure 4 – Page Views by User of the Workspace

It shows, for example, the number of days and hours a learner is using APEX. Whilst some of these statistics are not that clear (eg “Think” time on one particular screen!) and need to be treated cautiously in their reliability, they nevertheless provide an initial indication of level of engagement (including complete lack off!) which can be followed up if necessary with the particular student.

Section 6, however, includes a discussion of the limitations of APEX’s monitoring data in respect of helping to identify plagiarism.

## 6. TEACHING AND LEARNING OF MORE ADVANCED DATABASE APPLICATION DEVELOPMENT

The level 2 database unit, Database Application Development (mentioned briefly in the context section 2), covers both practical SQL development skills and a range of more theoretically based database design and application development issues including; concurrency control, access control and auditing within a DBMS.

### Context and Rationale for Using APEX Rather than Oracle Forms

In the first semester, the SQL work is undertaken using the Oracle text-based interface tool iSQL\*Plus. This allows students to concentrate on the SQL coding issues without spending time and effort on interface and other application development issues. However, it does have the disadvantage that many students are left with the impression that Oracle does not provide effective tools for creating usable applications. The use of a more sophisticated Oracle front-end development tool in the latter part of the unit is intended to both overcome this impression and to highlight the differences between using vendor specific application development tools, with their ability to automate database connectivity and query generation, and specialist interface development tools where these aspects need to be handled manually.

In the second semester students are required to consider the broader database development issues previously mentioned. The second assessed piece of work comprises a written report on one of these issues, covering; (a) the business issues, (b) the facilities provided by the Oracle RDBMS to enable these issues to be resolved (including commentary on the extent to which this varies between different RDBMS providers), (c) design work in relation to a given case study, (d) a sample application implementing (using APEX) part of the case study and illustrating at least one aspect of the Oracle RDBMS facilities discussed in the report.

In essence part (d) means incorporating into the application; views, database triggers, and sequences for access control, audit and concurrency respectively.

In previous years we have used Oracle Forms for the development work in semester two and have found it to be strongly disliked by students who found it counter-intuitive and, given the limited time available, found it almost impossible to achieve the same level of functionality that they had been able to implement in the Developing for the Internet unit using PHP and MySQL.

The principle areas of difficulty with Forms being; the need to structure the design of forms around the concept of data blocks, the plethora of Oracle specific terminology (eg triggers in place of events, alerts in place of message boxes, LOVs) and the clear separation between development of layout and functionality. (The Oracle Forms ‘layout editor’ tool is designed to do just that and very little else.) The end result of using

this tool being a reinforcement of the impression that enterprise databases generally and Oracle in particular do not provide usable tools for creating applications.

### **Outcome and Issues Encountered**

Therefore, following the successful use of APEX at level 1, a late decision was taken to also use APEX at level 2. Since the current cohort did not take the new level 1 unit last year most of them are using both SQL and APEX for the first time in 2008-09. As for the level 1 unit, workspaces have been set up for each group of 15-20 students. The following are our findings from this experience.

First and foremost, the students like this application. There are a significant number who have expressed the view that it was only when they started using this tool that they understood the value of the SQL work. Almost all are able to create a usable application without much difficulty and although a few are inclined to use the various wizards to create the functionality and then spend a disproportionate amount of time on things like creating fancy logos, most concentrate their efforts on adding functionality and make good use of their newly acquired knowledge of SQL to customise the wizard-generated elements of the application.

The shared workspaces (also discussed in sections 3 and 4) mean that it is not possible to allow (or require) students to use database schemas set up in their own Oracle accounts for the APEX work. They do not therefore have the opportunity to design and implement their own views, database triggers and sequences for this assignment as previous students have done when using Oracle Forms. We overcome this limitation by covering database schema design and implementation in the earlier part of the unit using iSQL\*Plus and individual Oracle accounts and have found that using a tutor generated schema for the latter part increases student confidence and allows them to concentrate on why views, triggers and sequences are important rather than what they should implement and how they are going to do so.

Another difficulty caused by using shared workspaces is the risk of plagiarism as students have full access to the work of other students in their group. We have not to date identified any cases of blatant plagiarism (at the time of writing the assessed work for the unit has not been submitted), however, there have been a number of instances of students, particularly the stronger students with more advanced applications, complaining that their work has been tampered with and corrupted by other students. The fact that the work in question has become corrupted suggests that this is more a matter of students trying to work out how to do things by looking at their colleagues work rather than wholesale copying. (To do the latter would simply involve exporting the application, changing the file name, then importing it, in which case the original application would not be corrupted.). Our initial expectations of being able to track any such undesirable activity using the built-in activity monitoring features has not in the event proved effective. Monitoring data is not available for deleted or over-written applications and since students are (on our advice) regularly exporting and re-importing their applications to ensure they have back-ups, the activity monitoring data has been of very little value from this respect. The reference to "changes can be tracked" in the administration guide in the appendix is something of a bluff!

We are hopeful that we will not find blatant cases of plagiarism but this risk should not be overlooked when designing assessments. In our case, the actual APEX implementation work represents only 10% of a 20 CATS unit (20% of this piece of work) so there is scope for finding a workaround if necessary. The use of demonstrations to ensure students understand the applications and group work to reduce the scope for copying without involving other students are also possible strategies that could be employed.

Another issue to be aware of is the fact that APEX is limited in its ability to handle compound keys. We have in the past used primary keys with up to three elements in order to achieve a level of complexity in joins without having to have too many tables for students to remember table and attribute names easily. Furthermore, this also offers the opportunity to discuss why this is not recommended in the first assessment where they are asked to evaluate and improve the given database design. When we were using forms it also gave us the opportunity to illustrate one of the advantages of the Oracle Forms standard LOV window display over the more conventional drop-down boxes. The basic structure of the database schema therefore had to be changed for this assessment. The built-in APEX 'Object Browser' helped the students to get to grips with the changes fairly rapidly.

Another issue that initially appeared to be problematic is the students' inclination to concentrate on APEX's application level security features rather the DBMS security features that they are intended to consider. However, in the end this turned out to be an advantage because it led to discussions on the advantages of DBMS level security enforcement rather than, or in addition to, application level security. Although this issue has always been discussed, we found that the ease with which application level security can be implemented in APEX, and therefore that Oracle provides for both, makes the issue more real for students.

### **Further Use of APEX**

Overall, notwithstanding the issues discussed, we regard the use of APEX as successful for teaching more advanced development, not least because of the students' enthusiasm for it. We will certainly be using it again next year when, since the students will already have studied basic SQL and APEX at level 1, it will be possible to extend the coverage using APEX and PL/SQL to include more advanced topics such as stored procedures and functions, database triggers and XML integration. This should enable the students to go much further with developing their APEX applications.

## 7. SUMMARY AND CONCLUSION

Table 1 summarises the key strengths and issues of using APEX for teaching and learning (T&L) discussed in this paper:

<i>APEX Strengths for T&amp;L</i>	<i>Issues for T&amp;L</i>
<b>Administration, Scalability and Reliability for Teaching</b>	
Convenient to allocate a class to a workspace	
Can map a workspace/class to a single schema	...although less scope for students to manage objects
Low maintenance once admin structure set-up	
Potential for admin of APEX accounts etc in class	...which overcomes lack of scripting ability
Proved generally to be both scalable and reliable	
<b>Teaching and Learning of Introductory Database Application Development</b>	
Students (90%) able to build at least basic application	...although some (10%) struggled with APEX
Adequate APEX online tutorials	...although still limited literature
Monitoring of common "student" errors – eg with SQL	
	Shared workspaces limits development of schema, but individual student/workspace/schema mappings time-consuming to setup (overcome by continuing to use iSQLPlus earlier)
<b>Promotion and Monitoring of Engagement and Feedback of Learning</b>	
Accessibility! <i>This facilitates:</i>	
Monitoring & feedback using "Application Window"	
Monitoring using the "Monitoring Activity" facility	...although some statistics not clear, and statistics not available for deleted applications
<b>Teaching and Learning of more Advanced Database Application Development</b>	
Liked by students more than Oracle Forms!	
Generally more intuitive and usable tool than Oracle Forms for developing more advanced applications	
	As for introductory database development above,, shared workspaces limits development of schema
	Risk of workspace plagiarism and insufficient "Monitoring Activity" data to help it (refer also above)
	Compound keys limitations
Enables comparison of app. and DBMS level security	

Table 1 – Summary of APEX Strengths and Issues for Teaching and Learning

We can see from the summary table and the discussion in this paper that the evaluation against each of the four criteria is generally positive, and therefore we can support and extend from the view of Tomlinson & Gardner [1] that APEX is an appropriate tool for the teaching and learning of enterprise databases.

We will now extend the use of APEX where appropriate to all our database units, and to continue to use it for the foreseeable future. In addition to improving our use of APEX in respect of the issues identified earlier, one further area of improvement is to establish a more methodical approach to applying APEX for developing applications. We will also explore any further potential to “excite” students. For example, it was fairly straightforward to demonstrate using APEX web service functionality to access Google Maps from an APEX form page.

Finally, it takes just a few minutes to establish a fully functional demo APEX account on the Oracle hosted service at [apex.oracle.com](http://apex.oracle.com). So try it now if interested and convinced!

## **8. REFERENCES**

- [1] Tomlinson, A. and Gardner, K. Teaching Enterprise Database Application Development Using Oracle Application Express. The 6th Workshop on Teaching, Learning and Assessment in Databases, Cardiff, UK, HEA (2008).
- [2] Oracle Application Express. <http://apex.oracle.com/i/index.html>.
- [3] Oracle® Database 2 Day + Application Express Developer's Guide.  
[http://download.oracle.com/docs/cd/E14373\\_01/appdev.32/e13367/toc.htm](http://download.oracle.com/docs/cd/E14373_01/appdev.32/e13367/toc.htm)
- [4] Rick Greenwald. Beginning Oracle Application Express. Wrox Programmer to Programmer.

## 9. APPENDIX

### Administration of the University APEX Development Environment

#### General

This is a guide for tutors and students about how the APEX development environment is set up for the "Introduction to Databases" unit. Please read first the "1 Introducing Oracle Application Express" in the "2-Day" Developer's Guide.

The environment is accessible at <http://apex.solent.ac.uk/pls/apex> Please note that workspace names, usernames and passwords are case-sensitive in APEX!

#### Workspaces and their Administrators

Each group has its own development and production workspace, and administrator, as indicated in the table below.

<i>Courses</i>	<i>Workspaces</i>	<i>Administrator</i>
BIT	BIT1, BIT1PROD	AI Monger (mongera)
	BIT2, BIT2PROD	Jing Lu (luj)
Computing	COMP, COMPPROD	Sheila Baron (barons)
	COMPSE, COMPSEPROD	Sheila Baron
	GAMES1, GAMES1PROD	Jing Lu
	GAMES2, GAMES2PROD	Jing Lu
	GAMES3, GAMES3PROD	AI Monger
Networking	WDES, WDESPROD	Sheila Baron
	WDIT, WDITPROD	AI Monger

Each workspace is assigned to the "OEHR Sample Objects" schema. This schema includes the HR and OE databases, and also other database "objects" (such as sequences) which are used implicitly by the tutorials.

Storage and other services can be requested by the administrator online from the academic APEX administrator (AI Monger).

#### Developers

All students are developers! Each student will have their own developer account in the workspace for their group. This will be created by the workspace administrator/tutor and student together in the classroom. Although Oracle and APEX authentication are independent, you should use the same username and password as for your Oracle account. When you first login, you may be required to change your password (change it to the same one!).

You are strongly recommended to define your username and password in uppercase. This will mean that all login details, including the workspace, will need to be in upper case.

#### Users

All students (and tutors) will act as users to use and evaluate applications. Each workspace therefore has at least one user account, USER, with password APEX. Although it appears that multiple user logins are permissible, your workspace administrator will create more users if necessary. A user does not have developer privileges.

#### Applications

You will all develop ONE assessed application which contains report, form, home and login pages. You must name this application using the format of surname followed your first name initial. For example, a student John Smith will name his application as SMITHJ.

You will also initially develop a practice application based on the tutorial. Name this as AnyCoCorp prefixed with your initials eg SMITHJAnyCoCorp.

You will see that you can view all of the applications (up to around 20 therefore) developed in the workspace by the group - DO NOT UNDER ANY CIRCUMSTANCES WHATSOEVER EDIT THE APPLICATION OF ANY OTHER STUDENT DEVELOPER'S APPLICATION – ANY CHANGES CAN BE TRACKED!

You must regularly save (export) your application to your u: drive or memory stick. It is quick and easy to import and reinstall your application.

### **Application Deployment**

You must deploy your application in the production environment. This is the workspace with the name of your development workspace followed by PROD. For example, the production environment for the WDI class/workspace is WDIPROD.

You will deploy your application through a single developer username and password of DEV and APEX, respectively. In other words, logon as DEV, and then import your application to the production workspace. This avoids having to create individual developer accounts for you in the workspace.

After importing your application to the production workspace, you will need to use the password APEX to run your application.

### **OEHR Sample Objects Schema**

Do not under any circumstances whatsoever modify this schema by, for example, creating tables in it.

In the “Building Your Application” tutorial, and later in the assessed activity, it is OK to test your pages by inserting, deleting and editing records. However, please reinsert exactly any record you deleted and vice versa, and do not do any more inserting, deleting and editing than is absolutely necessary. Under no circumstances whatsoever add any content that is “inappropriate”.