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## Using Oracle to Augment the Information Systems Curriculum

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## **USING ORACLE TO AUGMENT THE INFORMATION SYSTEMS CURRICULUM**

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**TUTORIAL**

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# USING ORACLE TO AUGMENT THE INFORMATION SYSTEMS CURRICULUM

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## ABSTRACT

Oracle Corporation makes its software products available to educational institutions at minimal cost. This tutorial explores options for procuring, installing, and administering an Oracle client/server database in an academic setting, and describes how the Oracle software can be used in specific areas in the information systems curriculum. It also presents results of a survey investigating how IS instructors currently use Oracle, and describes the benefits and challenges they are experiencing.

**Keywords:** Oracle, database education, client-server databases

## I. INTRODUCTION

Database management is an integral topic in today's information systems curriculum. The expanding use of the Internet for information exchange ensures that the concepts underlying the movement of data over communication networks using distributed architectures will be an increasingly important part of future IS curricula. Courses addressing database management, client/server concepts, and Web-based systems often include a strong programming component that allows students to apply concepts to real problems. Many institutions use personal database management applications such as Microsoft Access for the programming component in these courses.

During the past decade, Oracle Corporation made its client/server database management system and software products available to educational institutions through special programs, and occasionally included with textbooks. As a result, a substantial number of educational institutions moved from Microsoft Access to Oracle to illustrate the applied aspects of their database-oriented courses. This tutorial describes options for obtaining the Oracle software, approaches for using Oracle products in the IS curriculum, and strategies for implementing Oracle in an academic setting. It also describes results of a survey of IS instructors to investigate how Oracle is being used, as well as motivations, benefits, and problems.

## **II. OBTAINING ORACLE SOFTWARE**

Instructors can obtain Oracle software at minimal cost for academic use in two ways: (1) through the Oracle Academic Initiative, or (2) bundled with textbooks.

### **THE ORACLE ACADEMIC INITIATIVE**

Oracle Corporation made some of its DBMS and software development products available to educational institutions at a nominal charge through the Oracle Academic Initiative (OAI). Current details about OAI can be obtained at the OAI Web site (<http://oai.oracle.com>). At present, to qualify for OAI membership, an institution must be accredited by some accreditation body, offer degrees and classes for credit, not have Oracle-related courses be more than 70% of the overall curriculum, and not provide Oracle training for local businesses. OAI membership requires an annual \$500 licensing fee. Membership entitles the participating institutional unit to a variety of Oracle software products, as well as reduced prices for Oracle courseware and training.

Once an institution is accepted as an OAI member, it must select the Oracle server platform and the software products it wants to use. For new members, OAI ships the software products when the membership is approved. Continuing members select and receive new software products once per year, at

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the time of renewal. Oracle database servers are available to run on Windows NT/2000, as well as on a variety of UNIX platforms. Most instructors and technical support personnel think that Windows NT/2000 is the easiest installation and administration platform. UNIX-based installations usually require additional help from Oracle technical support personnel to install, create, and configure the database successfully.

Currently, OAI offers three software packages:

- the *Database Pack*, which provides the required database servers;
- the *Internet Developer Suite*, which provides the required client utilities for basic application development; and
- the *Internet Application Suite*, which provides the Oracle Application Server.

The Oracle Application Server is a Web server that can be used to distribute Web-based applications, and provide a means for remote database administration.

What is included in the *Database Pack*? To understand the Oracle database server options, it is important to keep in mind that an Oracle database installation is a combination of a database server and one or more client utilities. In an academic setting, two options are available for configuring the database installation.

1. A **client/server installation**, in which the database server runs on a central server, and the client utilities run on separate client (student) workstations. This approach allows students to share the same database data, and facilitates students working on team projects. Or,

2. a **personal database installation**, in which the database server and the client utilities all run on the same workstation. This approach is satisfactory when students do not need to share database data.

Table 1 summarizes the Oracle database server options.

Table 1. Oracle Database Servers

Server	Description
Oracle Enterprise Edition	Client/server database
Oracle Personal Edition	Personal database that can be installed on individual user workstations

The basic Oracle client/server database provided by the OAI is the *Enterprise Edition*. This database runs on a central server, and client workstations connect to the server using a TCP/IP network connection. Any client workstation with TCP/IP (Internet) access can connect to the server, regardless of the location of the client workstation.

The database server that supports the personal database installation is *Oracle Personal Edition*, which is a personal database that can be installed on individual user workstations. This installation allows students to run the database and the client on the same computer. This approach is useful for commuter students who want to work at home and do not need to share database tables and other objects. From a user standpoint, both of these database servers work the same.

What is included in the *Internet Developer Suite*? Table 2 summarizes the client utilities commonly used in academic classrooms.

- *SQL\*Plus* is the SQL command-line environment, which can be used for command-line SQL instruction, is included with every database server.
- *Enterprise Manager* is the database administration utilities that are also included with all of the database servers.

Other commonly-used educational products include

- *Oracle Designer*, which is a CASE tool for developing system models and generating the associated database tables and user application forms and reports, and

Table 2. Commonly-Used Oracle Client Utilities

Utility	Description
SQL*Plus	Command-line SQL
Oracle Enterprise Manager	Database administrations tools for creating databases, user accounts, and other database objects
Oracle Designer	CASE tools for developing system models and generating associated database tables
Oracle Developer	Tools for creating user application forms, reports, graphic charts, queries, and stored database procedures and libraries
JDeveloper	Web-based Java/database application development

- *Oracle Developer*, which is used to develop Windows-based user applications (forms, reports, and graphical charts) based on Oracle’s procedural programming language, called *PL/SQL*. (PL/SQL can also be used in the command-line SQL\*Plus environment.)
- *JDeveloper* is similar to Oracle Developer, except that it uses Java for its programming language rather than PL/SQL.

When you receive your Oracle software, expect to receive several CDs and little or no paper documentation. The installation instructions are provided on CD, and are somewhat abbreviated. OAI is striving to make installation and configuration easier, but installation is still a daunting task. The International Oracle Users Group-Americas (IOUG-A) has started an initiative to create a Web site that contains a “Best Practices” section that will contain, among other things, installation and configuration instructions aimed towards instructors and technical support personnel in academic settings. An “Oracle in Academia” list server exists where instructors using Oracle can post technical questions. Information for joining this list server can be found at [http://mail.uindy.edu/mailman/listinfo/oracle\\_in\\_academia](http://mail.uindy.edu/mailman/listinfo/oracle_in_academia)

## **ORACLE SOFTWARE BUNDLED WITH TEXTBOOKS**

Oracle makes some of its software available to students and academic institutions by bundling CDs containing Oracle products with Oracle-related textbooks. For example, CDs providing the Oracle Personal Edition DBMS and the Designer and Developer utilities can be purchased for a minimal amount when students purchase a systems analysis and design textbook [Hoffer et. al, 1999]. An Oracle systems development textbook [Morrison and Morrison, 2000a] enables students to obtain the Oracle Personal Edition DBMS and the Developer utility, and instructors can obtain the Enterprise Edition DBMS and the Enterprise Manager database administration software. The advantage of obtaining software using this approach is that students can then install and use the software on their home computers, and installation and configuration instructions are often included with the textbook instructor kits. Many instructors use a combination of OAI-obtained software together with software bundled with textbooks to take advantage of both approaches.

### **III. MAPPING THE ORACLE SOFTWARE TO THE IS CURRICULUM**

Table 3 provides ideas for applying Oracle software to Information Systems curricular areas.

Some instructors augment the systems analysis and design course using the Designer CASE tool, which provides an environment for developing system models (data flow diagrams and entity relationship models), and generating the associated database tables and user application forms and reports. This provides a direct link between the systems course and the database management course that usually follows.



Oracle's main strength is in supporting the database management curriculum. Some instructors choose to use only SQL\*Plus, which is Oracle's command-line SQL environment, for teaching SQL. Others use SQL\*Plus along with Developer which is Oracle's environment for developing database applications.

What does Oracle add to the database curriculum? It provides a more loosely coupled, production-style environment that forces students to truly understand distributed computing and client-server architectures. Many instructors use a combination of Access and Oracle. They use Access for teaching basic database and SQL concepts, and then move students into Oracle as their proficiency increases.

Table 3. Curricular Areas and Corresponding Oracle Utilities

Curricular Area	Oracle Product	Topics
Systems analysis & design	Designer	Data and process modeling; database application design
Introductory database concepts	SQL*Plus; Developer	SQL; database application development
Database application development/ Capstone project course	Developer; Oracle database accessed from a non-Oracle application development environment, such as Visual Basic or Web-based applications	Database application development
Advanced database concepts/database administration	Enterprise Manager	Database installation, administration, and configuration
Web-based Applications	JDeveloper or Developer; Oracle database with Web application development in other environment, such as Active Server Pages or Java Server Pages	

Oracle also provides a rich environment for teaching advanced database concepts and for supporting database projects. Both Developer and JDeveloper provide students with a production-style environment for creating large-scale database systems. The Enterprise Manager provides an environment for illustrating database administration tasks. And, the Oracle database can easily be used as a back-end database server for application development in other environments. We have students develop applications in Visual Basic, using Active Server Pages, and using ODBC to facilitate communication between the database and the application.

Our advice if you are considering adding Oracle to your curriculum: This is not a trivial task. Be sure you have adequate hardware and technical support. Lobby to send your technical support personnel to Oracle training. If you have to be your own technical support person, plan to spend many hours installing and configuring the software, and learning how to use it. Lobby for course release time and course development support funds.

#### **IV. CLASSROOM ADMINISTRATION**

When planning your Oracle installation, you need to decide if you will run a central database server and allow all students to connect from remote client workstations, or if you will run individual Personal Oracle databases on each student workstation. Running a central server requires being a member of OAI. Conversely, if you decide to run individual Personal Oracle databases, you and your students can obtain the software bundled with textbooks, or downloaded from Oracle at a reasonable cost. Our experience indicates that in the long run, running the central server is the easiest and cheapest option. Once the server is installed and configured, it requires very little maintenance. Conversely, running the Personal Oracle database on each student workstation requires the student workstations to be more powerful. The following sections provide detailed information about each type of installation.

## **SERVER HARDWARE SELECTION AND CONFIGURATION (CLIENT/SERVER INSTALLATION)**

We have successfully run the Oracle8i<sup>®</sup> Enterprise Edition database server on a variety of hardware platforms and network operating systems. Our hardware ranged from a 133 MHz Pentium I with 32 MB of RAM using an Oracle 7.3 DBMS, to a dual CPU 933 MHz IBM Netfinity server with 512 MB of RAM and a RAID disk array.

We've installed Oracle databases on the following network operating systems:

- Novell's Netware,
- VMS,
- Windows NT Server, and
- Windows 2000 Server.

Older versions of the Oracle database require less powerful hardware. When using Windows NT Server, Oracle's 7.3 database runs adequately on slower computers with at least 64 MB of RAM. If you upgrade to Oracle's 8.0 database with Windows NT/2000, a 200 MHz or better computer with at least 128 MB of RAM is needed. If you upgrade to Oracle's 8.1 or later databases on Windows 2000 Server, you will need a 500 + MHz computer with 256 MB or more of RAM.

Our advice for selecting server hardware is that you should not try to run newer versions of Oracle's DBMS on older, slower computers, and don't shortchange your server's RAM. Otherwise, your students will have to deal with slow database response along with the rest of the challenges that Oracle presents to them. If you select an Oracle8i<sup>®</sup> client/server DBMS, don't consider using a server with less than 256 MB of RAM, and strongly consider installing 512 MB (or more) of RAM.

## **Reliability and Maintenance**

We have a class database NT Server supporting approximately 70 students per semester that has been running continuously for four years with no down time, aside from shutting it down once two years ago to add RAM and upgrade from a 7.3 database to an 8.0 database. This server is just a 200 MHz Pentium Pro with 128 MB of RAM. It isn't an expensive fault-tolerant server; it's just an ordinary IBM desktop PC pressed into server duty. Probably the biggest contributor to this server's reliability and longevity is keeping it in the campus's air-conditioned, power conditioned, server room. Along with the hardware longevity, the Windows NT/ Oracle database combination proved robust. We have not experienced any crashes or software problems. (Note that this server is running the Oracle 8.0 DBMS. This server is not fast enough and does not have enough RAM to run a more recent version of Oracle's DBMS.)

## **Creating the Database**

A client/server database contains a set of user accounts and their associated database objects, such as tables, views, or stored programs. When the Oracle DBMS is installed on an NT or Windows 2000 database server, a starter database is created automatically. In a classroom environment, the instructor or technical support person should create all of the student accounts in this starter database. It is impractical to create a separate database for each student or each student group, because each separate database, which is called a "database instance," consumes a considerable amount of server CPU time, main memory and hard drive space.

## **Creating User Accounts**

Each student should have an individual user account that provides access to the database tables required to complete classroom assignments. Each student's database objects are then separate, and password-protected. Students with their own user accounts are able only to access their database objects. They are not able to access other students' database objects unless

those other students grant them explicit privileges to do so. The fastest and least error prone way to create multiple user accounts is to create an *SQL script*, which is a text file of SQL commands that can be run from SQL\*Plus, the Oracle SQL command line utility. (We wrote a simple Visual Basic program to read a text file containing user names using university-issued email usernames for our user account names to generate this script automatically.)

For classes with team projects in which students need to share database objects, we found it works best if every project team has a common database account with a common username and a different password for each team member. In this way, team members can easily access all of the team's database objects. In all cases, it is helpful to give the course instructor database administration privileges for the database so he or she can easily add or modify user accounts.

### **CONFIGURING THE CLIENT WORKSTATIONS (CLIENT/SERVER INSTALLATION)**

To run the most commonly-used classroom client applications (Developer and Designer), your client workstations must have Pentium-class processors running Windows 95, 98, or NT/2000, with at least 128 MB of main memory and about 200 MB of free hard drive space. This main memory amount is somewhat flexible. We successfully ran Developer on client workstations with 64 MB of memory, but it runs slowly, and users cannot multi-task between Oracle applications.

Like most complex Windows applications, Oracle client software utilities write many temporary files in a variety of places on the local hard drive. As a result, client workstations in computer laboratories must be configured so that users and applications can perform all file operations (read, write, execute, delete, create) on all of the files in the folder where Oracle is installed, as well as on some files in the Windows system folder. This arrangement might pose a problem in computer laboratories with highly restrictive file and folder configuration policies. Initially, we tried to run the Oracle client software in

computer laboratories with restrictive policies, but our experience was that the software was very unstable and in some cases would not work at all. When computer laboratory management personnel adopted a philosophy of creating regular disk images that enabled fast workstation restoration rather than using excessive restrictions to keep laboratory workstations running, the Oracle client software worked very well. It is also important for the client software to be installed on each individual workstation. It will not run from a file server.

### **Managing Student Assignments and Team Project Files**

Since students can easily modify SQL query outputs and Developer form and report printouts to create outputs that appear to be correct, we always collect electronic copies of class assignments and perform grading online. Online grading can be done by collecting floppy diskettes, by having students submit assignments via FTP, or by having the students copy files into individual network server folders where permissions for reading and modifying files are only granted to the individual student and to the instructor. Since some Oracle files can be over 1 MB in size, floppy diskettes might not work for complex assignments. We successfully administered team projects by providing each project team with an individual folder on a network server for which each team member has full access privileges. Since it is time-consuming for the instructor to log onto the database using each individual student account, we configured many of our assignments with everyone using the same database tables. In this way, the instructor can simply log onto the database using this standard account, and check any student's solution files to make sure they work correctly.

### **WORKSTATION CONFIGURATION (PERSONAL ORACLE INSTALLATION)**

Installing both the Personal Oracle database and the client utilities on the same workstation requires a Pentium-class computer. For Windows 2000 or Windows NT installations, the workstations must have at least 128 MB of main memory, and 800 MB of free hard drive space. For Windows 98 installations, the

workstation must have at least 64 MB of main memory and at least 600 MB of free hard drive space.

## **V. CURRENT ORACLE PRACTICES**

To gain insight into how instructors at other academic sites use Oracle, we created and administered a 15-question survey. The survey was distributed electronically through the ISWorld list server during June 2001, and also through the special interest "Oracle in Academia" list server referred to in Section II. The survey was directed towards individuals who considered using Oracle, are using Oracle currently, or used Oracle in the past and are no longer using it. Eighty-five usable responses were received. . The survey instrument is presented in the Appendix.

The initial survey questions asked the respondent to specify their current DBMS, and their reason for selecting this product. For Oracle users, respondents were asked to specify the nature of their use (teaching or research), and how the product was obtained (OAI, bundled with a textbook, or other). Oracle users were also asked to identify the curriculum areas that Oracle is being used to support, the course levels (undergraduate, graduate, etc.), and specific Oracle products being used. We posed open-ended questions asking respondents to describe their motivations for using Oracle, and the benefits and challenges they encountered. Respondents were asked to rate the ease or difficulty that they experienced with selecting, installing, configuring, and administering the software. The survey also requested demographic data about the instructor and his/her institution.

### **DEMOGRAPHIC DATA**

Table 4 summarizes the respondent demographic data. The majority of the respondents (75%) described their job title as professor, which likely reflects the population of the distribution lists. The respondents were evenly distributed

among doctoral and non-doctoral 4-year institutions, with a few respondents from technical/professional colleges and 2-year colleges.

Table 4 – Survey Respondent Demographics

	Title			Institution			
	Professor	Instructor	Other/No Response	PhD	4-Year	Technical/Profession	Other/No Response
# of Responses	64	13	8	34	36	5	10
% of Total	75%	15%	9%	40%	42%	6%	12%

### DBMS SELECTION AND PRIMARY USE

The first survey question addressed the primary DBMS respondents were using. Choices included Access, SQL Server, Oracle, and IBM DB/2, as well as an open-ended category in which the respondent could indicate an alternate choice. Table 5 summarizes the responses.

Table 5 – Main DBMS Used by Respondents

	DBMS					
	Access	SQL Server	Oracle	IBM DB/2	Multiple DBMSs	Other/No Response
# of Responses	5	3	66	0	9	2
% of Total	6%	4%	78%	0%	11%	2%

In light of the target audience (individuals considering using Oracle, actively using Oracle, or used Oracle in the past), the fact that 78% of the respondents indicated their main DBMS was Oracle was not surprising. What was interesting was that no respondents were using IBM DB/2, which is considered the up and coming relational database behind Oracle in the corporate world.

Insights were gained on why people gave up on Oracle. Three respondents reported that they had used Oracle in the past and had discontinued its use due to technical or operational difficulties. The overriding reason was that faculty members were overwhelmed with the complexity of installing and learning



Oracle. One respondent stated, “Teaching both the data modeling concepts and Oracle in the same course demands too much from the students.” Another interesting finding was that 11% of the respondents indicated that they used a combination of databases, primarily Access and Oracle. Most noted that they use Access for teaching introductory database concepts, and Oracle for teaching advanced client/server concepts.

The next question specifically asked Oracle users whether they were using the databases primarily for teaching or research. The overwhelming majority (94%) indicated they were using Oracle mainly for teaching. Only 2 respondents (2.5%) indicated their primary use was research. The remaining 3 respondents (3.5%) indicated they were using the software primarily for administrative tasks.

### **SOFTWARE SOURCES**

The next set of questions asked Oracle users to identify whether they are obtaining the software through the OAI, through textbooks, or through other sources. Results are summarized in Table 6, and illustrated in Figure 1.

Table 6 – Oracle Software Sources

	Software Sources			
	OAI Only	Textbook Only	Both OAI & Textbook	Other
# of Responses	54	5	15	11
% of Total	64%	6%	18%	13%

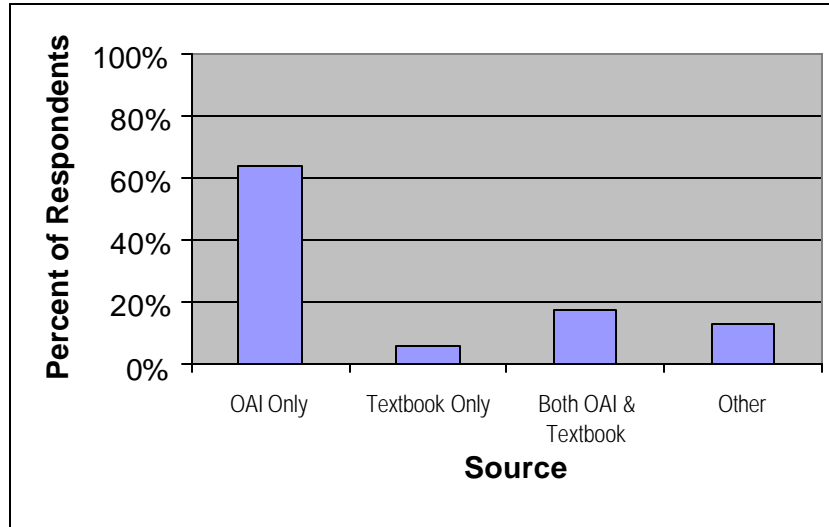


Figure 1. Software Sources

OAI appears to be the primary Oracle software source. The majority of the respondents (64%) are getting the software solely through OAI, while 18% are using both OAI and textbooks. The respondents who described their software source as “Other” mentioned university site licenses, as well as the Workforce Development Program, an Oracle program that provides ongoing workforce training to continuing education students.

### CURRICULAR AREAS AND COURSE LEVELS

The next set of questions addressed curricular areas and course levels in which instructors use the Oracle software. The survey asked respondents to indicate if they are using Oracle products to support introductory IS topics, database concepts/SQL, database applications, systems analysis and design, client/server topics, Web database development, or other topic areas. Results are summarized in Table 7, and illustrated in Figure 2.

Table 7. Curricular Areas in which Oracle is Used

	Curricular Area					
	Intro. Topics	Database Topics	Database Applications	Systems Analysis & Design	Client/Server	Web Development
# of Responses	4	68	31	23	17	17
% of Total	5%	80%	36%	27%	20%	20%

A large majority (80%) of the respondents reported using Oracle in the database topics area, with the Oracle software being used to a lesser degree in the other curricular areas. Thirty-seven respondents (44%) reported that they only use Oracle in the database topics course, while 36 respondents (42%) reported they were using Oracle in multiple curricular areas. For topic areas beyond the ones listed, respondents reported using Oracle to teach database administration, large systems development, and to attain the Oracle Certified Professional (OCP) certification.

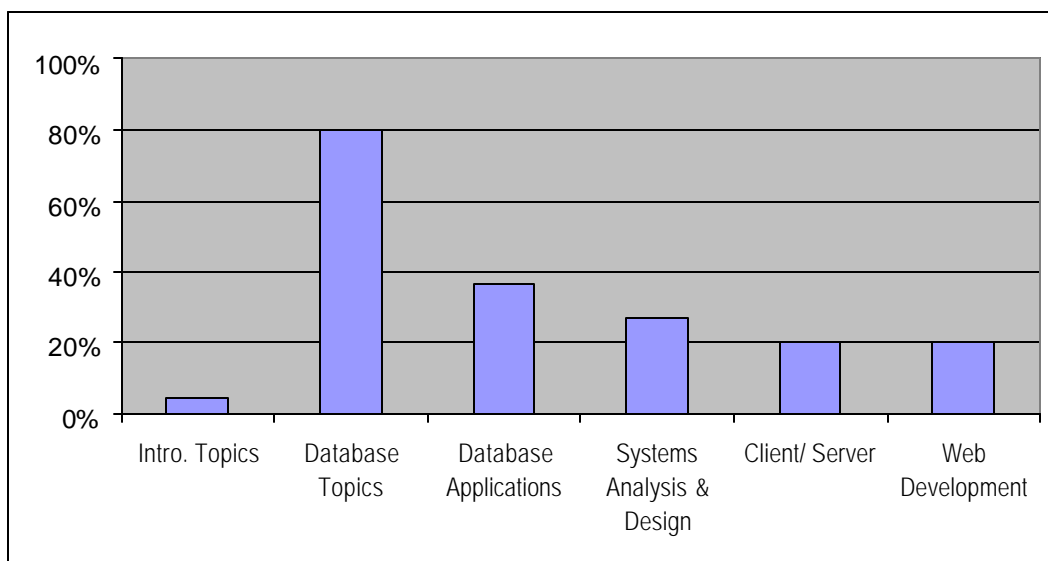


Figure 2. Curricular Areas

Respondents were also asked to indicate the course level at which they teach Oracle. These results are summarized in Table 8. Approximately half of the respondents use Oracle for only undergraduate classes, and half use Oracle for both graduate and undergraduate courses. Eight respondents reported using Oracle for technical/professional classes, and the remaining respondents indicated that they were not using Oracle at any level. The usage levels seem to reflect whether the demographics of the respondents' institutions: if an institution has a graduate program, then Oracle is probably used in graduate as well as

undergraduate classes. No respondents were using Oracle only for graduate courses.

Table 8. Oracle Course Levels

	Course Level		
	Undergraduate Only	Both Undergraduate & Graduate	Technical/Professional
# of Responses	34	33	8
% of Total	40%	39%	9%

### ORACLE DBMS AND CLIENT SOFTWARE USAGE

The next set of questions addressed which DBMS and client tools respondents use. Respondents were asked if they were using Oracle Enterprise Edition, Oracle Personal Edition, or another Oracle DBMS. Table 9 shows that 69% of academic users are using the client/server configuration, while 25% percent of the respondents report using Personal Oracle. Most of the respondents selecting “other” specified that they use a client/server configuration in their computer laboratories, and students use Personal Oracle on their home computers.

Table 9 – DBMS Being Used

	DBMS		
	Enterprise Edition	Personal Oracle	Other
# of Responses	59	21	5
% of Total	69%	25%	6%

To identify the most popular client tools, respondents were asked to select one or more client tools from the choices shown in Table 10.

Table 10 – Client Tool Usage

	<i>Client Tools</i>						
	SQL*Plus	Database Admin. Utilities	Developer	Designer	Oracle Application Server	JDeveloper	Other
# of Responses	76	26	40	24	10	4	7
% of Total	89%	31%	47%	28%	12%	5%	8%

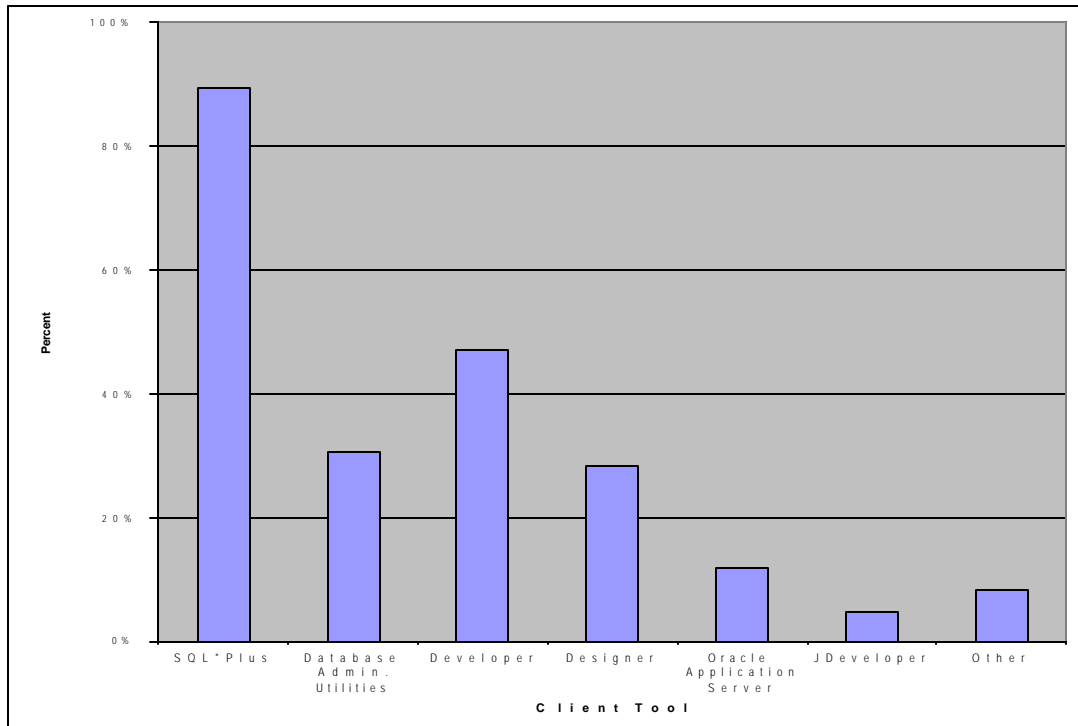


Figure 3. Client Tool Usage

The results, which are also illustrated in Figure 3, show that virtually all respondents who are actively using Oracle are using SQL\*Plus, the command-line SQL environment. The next most popular client tool is Developer, the end-user forms and reports development utility. Other popular client tools are the database administration utilities (31%), and Designer, the Oracle CASE tool (28%). Respondents selecting “other” tools specified using PL/SQL, which is Oracle’s procedural programming language, and using Oracle as a back-end

database for Web applications. It is interesting to note that when we distributed a similar survey two years ago [Morrison and Morrison, 2000b], 42% of the respondents reported using Designer. Thus, use of Designer appears to be declining. Many instructors complain that Designer is difficult to install and configure.

## **MOTIVATIONS FOR USING ORACLE**

The next set of questions explored factors that motivate instructors to use Oracle in their courses. As a result of discussions with other instructors using Oracle, we identified the main factors to be:

- (1) Required within an academic unit;
- (2) To give students a competitive edge;
- (3) For pedagogical reasons, because it provides a superior learning environment;
- (4) Cost;
- (5) Instructor personal interest.

We also included an “Other” category to allow respondents to indicate alternate motivations. Figure 4 illustrates our findings. These results indicate that the primary motivation is to give students a competitive edge in the marketplace. Forty-one percent of the respondents also indicated that Oracle provides pedagogical advantages. Respondents specifically noted that Oracle provides a “realistic” environment, and provides an environment for large system development. Another respondent noted that it is useful to teach both Access and Oracle, and highlight the differences.

## **EASE OR DIFFICULTY IN SELECTING, INSTALLING, CONFIGURING, AND ADMINISTERING ORACLE**

To augment Oracle in the IS curriculum, instructors and/or technical support personnel must select and install the Oracle database server and client software. Then they must configure the software by creating links between the client

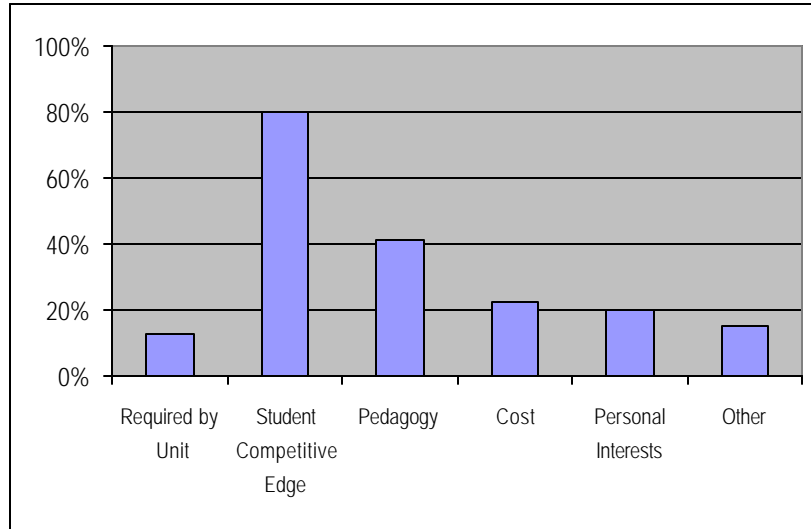


Figure 4. Motivations for Using Oracle

workstations and the server database and create the databases and user accounts. Instructors must find adequate teaching materials, and someone must administer the database on a day-to-day basis by performing tasks such as creating new passwords and updating database configuration parameters. We asked respondents to rate how easy or difficult they found each of these tasks using a 5-point Likert scale, with 1 being very easy and 5 being very difficult. Respondents were also given the option of stating that they did not perform a given task. Results, illustrated in Figure 5, are compared with the results (Morrison and Morrison 2000b) that we obtained from the survey in 1999.

The results indicate that current users are experiencing similar levels of ease or frustration as they were two years ago. Current Oracle users find the tasks of installing the database on the server and finding adequate teaching materials to be the most difficult. Interestingly, today's users are experiencing a higher level of difficulty with installing the client tools, and with daily administration than did the users we polled two years ago. We hypothesize that these tasks have not

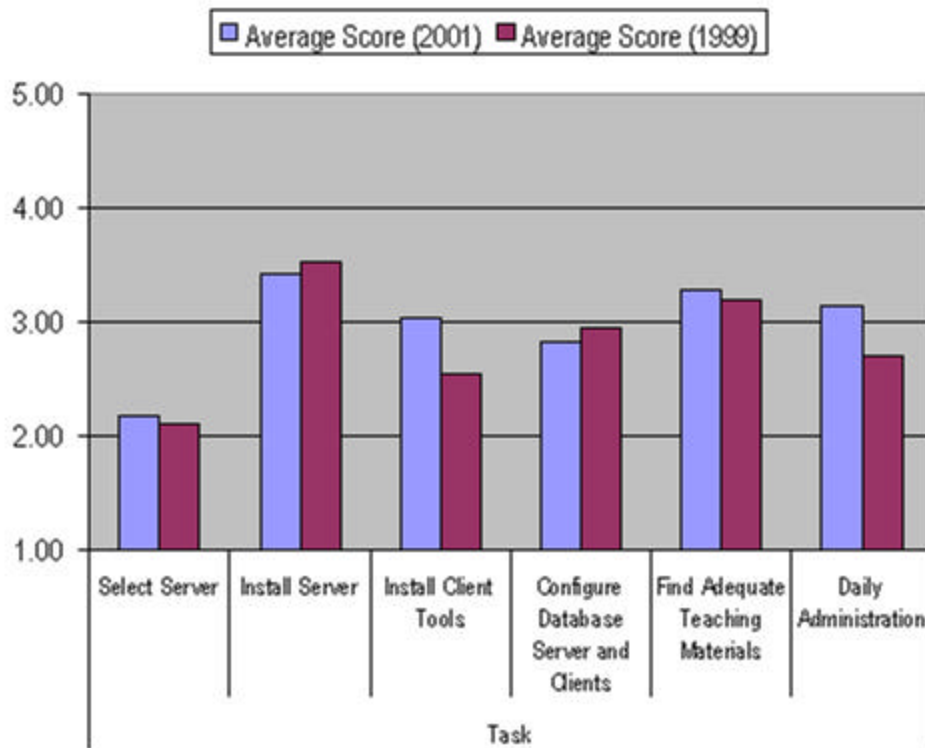


Figure 5. Ease or Difficulty of Oracle Task (5-Point Likert Scale)

become more difficult, but rather that this higher perceived difficulty is because more instructors are using Oracle today. A few years ago, only the most technically adept and motivated instructors used Oracle. Perhaps less experienced or motivated instructors using Oracle today are voicing a higher level of frustration. Even though several Oracle-directed textbooks and Oracle-supplied teaching materials are available today that were not available two years ago, instructors are still not satisfied with Oracle teaching materials.

### **BENEFITS AND CHALLENGES**

Some of the most interesting information was obtained from the final two questions, which asked instructors to describe the benefits derived from using Oracle, and the greatest challenges posed by using Oracle. The following sections summarize both the benefits and the challenges.



## Benefits

Based on the responses, benefits fell into the following categories:

- *Exposure to a scalable, multi-user DBMS.* As noted earlier, Access provides an almost seamless database environment, while Oracle provides a series of loosely coupled tools that accurately reflect what students will encounter in production database environments. One respondent described Oracle as a "...stable, high-usage environment ...". Another noted that it "...provides the student with a realistic environment for database development." Yet another noted, "...the largest benefit is the students have experience with an industrial strength database."
- *Demonstrating advanced database concepts.* While Microsoft Access provides an excellent environment for teaching basic database concepts, it does not adequately demonstrate more advanced concepts such as client/server and transaction processing. One respondent notes, "The students get a sense that there is more to the world of computing than small networks and Access." Another states, "[Oracle] provides a more realistic environment than a single-user DBMS such as Access ... I require each team member to create tables in their own workspace and to grant appropriate privileges to their partner and to use synonyms for tables created by others. That's the way things work in the real world, and I think Oracle simulates that environment very well." Another notes, "Security features, file locking, rollbacks, etc. can be demonstrated on this [Oracle] system and therefore help the student see the big picture." In terms of supporting classes addressing advanced database concepts, a respondent states, "...Oracle has enough sophistication to be used in an advanced database class, data mining class, or data warehousing class."
- *SQL compliance.* Multiple respondents asserted that Oracle provides a superior environment for teaching SQL. They described it as "Fully SQL

compliant ...”, "...[Supports] industry standard SQL..." and "...SQL is really supported (not just partly).”

- *Cost.* The affordability of Oracle appeared to be a consideration. One respondent noted, “It's free, which allows us to spend money on other facilities.”
- *Student benefits in the job market.* Several respondents noted that students gain a competitive edge based on their Oracle experience: “Students received training in software that helps them with jobs,” “...[Oracle is] popular in the market – [it] helps students' resumes,” and “Students received better job offers.” This benefit can potentially provide motivation to students to learn. One respondent noted, “Many students want to learn Oracle, so it helps promote the teaching of SQL and DB concepts.”
- *Enhanced instructor credibility and skills.* Several respondents stated that using Oracle benefits them professionally. One notes, “I gain valuable (marketable) skills and credibility by knowing the platform.” Another states, “It keeps me up to date.” Yet another adds, “[Oracle gives me] added credibility with the students.” One respondent noted the link between Oracle knowledge and academic research: “[Oracle] also gives me an insight into a complex database environment, which can be applied to research.”
- *Ease of use.* A surprising finding was the number of instructors who stated that they find Oracle easy to use. Respondents noted, “Once configured properly, it is easy to maintain and operate,” “Rather easy to setup and administer,” “Very good technical support. Good documentation. Great training materials,” and “OAI responsiveness, Oracle documentation, and metaLink [Oracle's online Web-based Help

system] have all been outstanding.” Another respondent states, “Bottom line: saves me time and provides for an outstanding learning experience for our MIS majors.”

## Challenges

When describing Oracle’s challenges, respondents were very vocal. We identified the main challenges as:

- *Difficulties with software installation and configuration.* Many respondents are still struggling with successfully installing the database server and client tools. Specific problem areas noted by respondents include “Getting the client and the server software to talk to each other,” “Installation and implementation problems abound ... the more Oracle products you install, the more compatibility and integration issues you have to keep track of...” One respondent eloquently states this difficulty as “Getting the bloody software to run.” An insightful respondent notes, “You have to learn from a lot of experience. For example, having to install the software several times before it runs effectively and efficiently.” Other respondents noted the difficulties experienced by students installing Personal Oracle on their home computers: One instructor stated, “My students have a difficult time installing and running Oracle.” Another stated, “Some students don't follow directions on installing Personal Oracle at home ... they are used to a wizard type installation and they just try to wing it ... for the students that don't follow the directions, it can be a real mess.” Our experience confirms this: an incorrect Personal Oracle installation at least requires manually modifying system registry entries, and possibly reinstalling your operating system.
- *Lack of adequate hardware facilities.* The Oracle software requires high-end workstations, which many institutions do not have. One respondent noted, “The packages are resource hungry and with 120 students our

aging server has problems.” This problem seems to be receding, however, since it was not widely mentioned.

- *Lack of adequate technical support.* Many respondents experience frustration because they feel their institutions do not provide adequate technical support for installing and administering Oracle. “Lack of adequate technical support at my institution” was an often-repeated theme. One respondent notes: “I do not have a DBA. I’m not going to get a DBA, the university can’t afford to pay for one.” One respondent described the lack of trained support staff as “Finding facilities management staff with adequate skills to fix any problems.” Another notes, “Personally, I think if our university would send support staff for training we would have fewer problems.”
- *Frustration with Oracle and OAI.* While some respondents spoke in glowing terms about OAI and Oracle technical support, others expressed frustrations, such as “... not enough support when things go wrong...” “...Dealing with the Oracle administration and bureaucracy...” and “Oracle and its “Rules.” One particularly incensed respondent expressed his or her frustration as follows: “Obtaining any answers to questions from Oracle Corp is almost as difficult as obtaining the software itself through their academic initiative ... Oracle Corp does not support the academic initiative.”
- *Lack of adequate teaching materials.* Even though Oracle has been available to academic institutions for several years, instructors are still having problems finding satisfactory teaching materials. They note frustration with “...Obtaining sufficient teaching materials - especially for Designer” and “...Lack of focused textbooks and lack of instructor training.” Another noted the difficulty of “Getting understandable

materials. These [authors] may be technical geniuses, but they are poor at explaining things to us non-geniuses.”

- *Scope of Oracle.* Several respondents note that the complexity of learning Oracle can impede teaching basic database concepts. One states, “For an undergraduate first class in database, Developer and Designer are too complicated.” Another concludes, “Teaching both the data modeling concepts and Oracle in the same course demands too much from the students.”

## VI. CONCLUSIONS

This tutorial shares rationales for using Oracle to enhance your curriculum, as well as practical advice for procuring, installing, and configuring Oracle. Oracle provides a rich environment for illustrating that the organizational database is a central data resource that is independent of the user applications. Oracle provides an excellent environment for teaching SQL, and for illustrating client/server concepts and advanced database topics. The Oracle Academic Initiative and Oracle software that is bundled with textbooks provide instructors with an easy and inexpensive way to obtain the Oracle software for use in the classroom. However, installing, configuring, and teaching with Oracle require considerable effort on the part of instructors and technical support personnel.

Our recommendations? Oracle will enhance your curriculum and your student’s experiences, but don’t undertake introducing Oracle into your curriculum lightly. Expect to spend many hours and experience some level of frustration during the entire process, from selection and procurement through installation, configuration, and finally learning the tools well enough to start teaching them to your students. Lobby to obtain adequate technical support with specialized training, and course release time for yourself. During the process, your students will probably become frustrated with you because you don’t know all the answers.

The rewards? Oracle provides a real-world environment that motivates students, helps them learn more, and helps them get better jobs. It also provides

instructors with skills that are highly sought after in the marketplace, and gain respect from students.

Editor's Note: This article is based on a tutorial presented at AMCIS 2001 in Boston, MA. It was received on July 3, 2001 and was published on August 23, 2001.

## APPENDIX

### DATABASE SOFTWARE ACADEMIC USAGE SURVEY

This appendix shows the survey used to obtain the data reported.

#### THE SURVEY FORM

Please complete this survey if you are currently using any database management system (DBMS) for any higher education use

1. Please select the main database management system that you are using:

- Microsoft Access
- Microsoft SQL Server
- Oracle
- IBM DB2
- Other (please describe):

If you are using a DBMS other than Oracle, proceed to Question 2, describe your reason for not selecting Oracle, and do not answer the rest of the survey questions. If you are using Oracle, proceed to Question 3 and answer the rest of the questions.

2. Reason for not selecting Oracle:

3. Please describe your primary use of Oracle:

- Teaching
- Research
- Other (please describe):

4. Please indicate how you obtained the Oracle software (check all that apply):

- Oracle Academic Initiative
- Bundled with a textbook

Other (describe):

5. If you are currently using Oracle for teaching, please select the course topic area(s) in which you have are using the software:

- Introductory computer concepts
- Database Concepts/SQL
- Database Applications
- Systems Analysis/Design
- Client/Server systems

Others (please list):

6. If you are using Oracle for teaching, please indicate the course (check all that apply):

- Undergraduate
- Graduate
- Technical/Professional

Others (please list):

7. Please indicate the primary Oracle database server that you are using:

- Oracle Enterprise or Workgroup Server
- Personal Oracle
- Other (describe):

8. Please indicate the Oracle client utilities that you are using (check all that apply):

- SQL\*Plus
- Database Administration Utilities
- Developer or Developer/2000
- Designer or Designer/2000
- WebDB or other Web tools
- JDeveloper

Others (please list):



9. If you are using Oracle for teaching, please indicate the factors that describe your motivation for incorporating Oracle into your curriculum. You can check as many choices as apply.

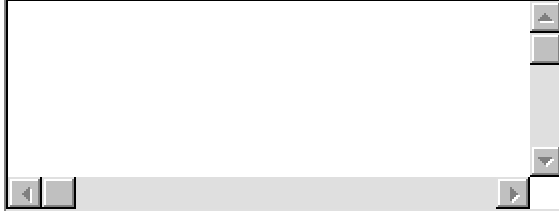
- Required by my department or unit
- To give my students a competitive edge in the marketplace
- Provides a superior environment for teaching database concepts
- Cost
- Own personal interests

Others (please list):

10. Please rate how you found the following tasks on a scale of 1 (Very Easy) to 5 (Very Difficult). Indicate tasks that you did not perform or are not familiar with using N/A (Not Applicable).

Task	Very Easy				Very Difficult	Not Applicable
Selecting the server and client software	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3	<input type="radio"/> 4	<input type="radio"/> 5	<input type="radio"/> N/A
Installing the server software	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3	<input type="radio"/> 4	<input type="radio"/> 5	<input type="radio"/> N/A
Installing and configuring the client software	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3	<input type="radio"/> 4	<input type="radio"/> 5	<input type="radio"/> N/A
Creating and configuring the database and user accounts	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3	<input type="radio"/> 4	<input type="radio"/> 5	<input type="radio"/> N/A
Finding adequate teaching materials	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3	<input type="radio"/> 4	<input type="radio"/> 5	<input type="radio"/> N/A
Administering the database on a daily basis	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3	<input type="radio"/> 4	<input type="radio"/> 5	<input type="radio"/> N/A

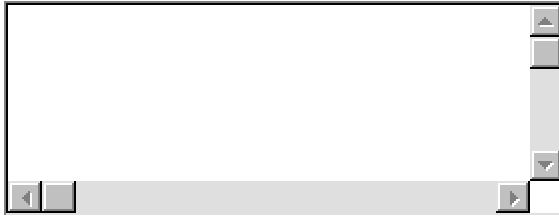
11. Please describe the benefits that you have found with using Oracle.

A large rectangular text input field with a vertical scrollbar on the right and a horizontal scrollbar at the bottom.

12. Please describe the biggest challenges that you have encountered with using Oracle.

A large rectangular text input field with a vertical scrollbar on the right and a horizontal scrollbar at the bottom.

13. If you are planning to discontinue using Oracle in the near future, please list your reasons:

A large rectangular text input field with a vertical scrollbar on the right and a horizontal scrollbar at the bottom.

14. Describe your job title:

- Professor
- Instructor
- Other (please describe):

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15. Describe your institution:

- Public/private doctoral granting institution
- Public/private institution granting Bachelor's or Master's degrees
- Technical/Professional School
- Other (please describe):

A small rectangular text input field with a vertical scrollbar on the right and a horizontal scrollbar at the bottom.

If you would like to receive tabulated results of the survey, please provide your email address here.

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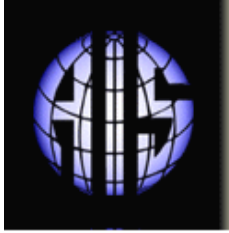
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