# STUDYING DATABASE PROBLEMS IN SMALL BUSINESSES

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This study investigates the database (DB) environment of university presses across the United States. A questionnaire survey was administered to database administrators (DBAs) of university press DBs, followed by semi-structured interviews. The survey and the semi-structured interviews were conducted to determine the tasks, system environment and problems that DBAs of university presses encounter.

The presses surveyed had multiple operating systems (OSs) and/or database management systems (DBMSs). The importance of mailing functions and exporting monthly financial reports arose in the interviews. The majority of the DBAs interviewed said that there was little documentation of the press DB and the press was either migrating or planning to migrate to a new DBMS. As time continues, the tasks of the DBA and the DB environment will continue to get more complex. Software designers of DBs need to take into account the needs of small businesses by dividing the increasing job responsibilities of the DBA between intelligent automated software and other stakeholders in the DB environment.

Headings:

Database Administrators

Database Management Systems

Software Analysis

Data Quality

University Press

Usability

## 1. Introduction

Small businesses use databases (DBs) to store information for a variety of tasks. Small businesses may initially invest in DBs as a special project, but as time passes, the information that is stored in the DBs becomes crucial to daily work processes. The data inside the DB becomes more complex as more features are added to the system. After the DB is tied to work processes, the small business must spend resources in the upkeep and maintenance of the information system.

Small businesses that are not technology focused companies face interesting challenges when it comes to the maintenance of their database management systems (DBMSs). They often have a small staff in the information technology department. In general, only one or two people are responsible for the majority of the system administration duties. These duties could include web development, DB development, providing systems administration for computers and providing help desk assistance. The software and the hardware are often in need of upgrades because budget funds for these items of the business are scarce. In some cases, the company may outsource the DB work and computer work to a different company entirely.

University presses represent an excellent example of how small non-technology focused businesses operate. University presses themselves are usually small to medium sized, and devote one or two people to oversee the DB related information systems.

I participated in a reverse engineering project of a small university press DB, at a company I will call UP. The reverse engineering project required me to look at the data and the fields inside the DB and to design a schema based on that information. The goal of the project was to document the logical structure of the DB for UP. The reverse engineering project made me think about other university presses and their needs in terms of DBs. I observed the DBA at UP completing tasks related to several positions such as system administrator, help desk technician, and web designer. There was also a greater need for documentation of DB systems.

This study explores the question: what is the role of database administrators (DBAs) at small businesses and what is their DB environment like? Based on the results of the research, I hope to gain some understanding of how DBMSs could be improved for small businesses.

**2. Literature Review**

After working at UP, I became interested in the DB software, and hardware environment of university presses. I was shocked to find a lack of documentation of the logical structure of the DB at UP and I wondered if the situation I observed at UP was widespread. I wanted to learn the state of other university press DBs. Specifically, I was interested in the types of DBMSs, the quality of the data inside their DBs, and the tasks that DBAs at university presses performed.

Two useful books that provided an overview of the DB environment and DBA tasks were *Fundamentals of Database Systems* (3rd ed.) by Ramez Elmasri and Shamkant B. Navathe and *Oracle Database Administration: The Essential Reference* by David C.

Kreines and Brian Laskey. These books break down the components of the environment and the users. The components of the DB environment are the DB, the DBMS, and the stakeholders of the DB.

Elmasri and Navathe (2000) divided the stakeholders of the DB environment into "actors on the scene" and "workers behind the scene." The actors on the scene work with the DB daily. The actors are responsible for design, use and administration of the DB. Elmasri and Navathe (2000) associated the workers behind the scene with "the design, development, and operation of the DBMS software and system environment" (p. 13). Elmasri and Navathe divided the actors on the scene into four groups, end users, DBAs, DB designers, systems analysts and applications programmers. In this study, I was concerned with the DBAs and the DB designers because they are responsible for the DB environment at the job.

Elmasri and Navathe (2000) stated the tasks of DBAs as including, "authorizing access to the database, for coordinating and monitoring its use, and for acquiring software and hardware resources as needed" (p. 12). They viewed the DBA as the chief resource manager.

Elmasri and Navathe (2000) described the tasks of DB designers as including, "identifying the data to be stored in the database and for choosing the appropriate structures to represent and store this data" (p. 12). Elmasri and Navathe also said that it was the responsibility of the DB designer to "communicate with all prospective database users, in order to understand their requirements and to come up with a design that meets these requirements" (p. 12). They viewed the DB designer as the person who worked

with the data and the views inside the DB, so that it reflected the outside view of the different user groups and the work processes of the organization.

Kreines and Laskey took a different approach to defining the DBA's tasks. Kreines and Laskey (1999) outlined the methodology used by the Educational Testing Service (ETS) in a study to compile a list of DBA tasks.

> 1. A group of experts was asked to assemble a laundry list of the tasks, skills, and abilities required of a DBA. A survey instrument was developed that listed these items along with a rating scale for the importance of each item.
> 2. The survey was administered to a large number of Oracle DBAs around the world.
> 3. The survey results were tabulated, yielding an average importance rating for each task, skill, and ability. Those falling below a predetermined cutoff level were eliminated. (p. 3)

Kreines and Laskey then presented a summary of the results from the ETS study. The ETS study summarized in Kreines and Laskey (1999, p. 4) divided the DBA job description into seven major groups, "Oracle architecture and options, security, data administration, backup and recovery, software maintenance and operation, resource management, and tuning and troubleshooting." Each major group was further subdivided into minimum requirements for the DBA. Some of the requirements were specific to the Oracle DB, but other tasks were universal to the job of the DBA.

Oracle architecture and options contained tasks related to navigating the structure of the DBMS and its different features. Security tasks dealt with adding or deleting user accounts, and granting and revoking access to the DB. Data administration involved the tasks of implementing the DB from the logical design. Data administration involved weighing the different costs of implementing stored procedures to enforce business rules. Backup and recovery tasks involved understanding backup options and developing

strategies to backup or recover the DB. Software maintenance and operation tasks dealt with installing and upgrading DBMSs, configuring the DBMS, and understanding related operating systems (OSs). Resource management tasks involved performing capacity planning, managing memory, and managing table spaces. Tuning and troubleshooting tasks involved diagnosing and resolving conflicts involved, collecting and analyzing performance information, and implementing appropriate solutions to DB performance problems.

Based on those groups Kreines and Laskey said, "…the job of the DBA is composed of a number of major tasks: database installation, configuration, backup and recovery, networking, and much more" (p. 6). Kreines and Laskey try to provide the Oracle DBA with the basic information they will need to complete the major tasks and try to present this information in a logical order.

The work done by Elmasri and Navathe, and by Kreines and Laskey define the traditional roles of the DB and the environment. The authors of both works assumed that the DBAs were responsible for large complex DBs. Elmasri and Navathe divided the tasks related to the DBA into two separate job categories, the DBA and the DB designer. For university presses, the division of DB duties may not be possible because the staff is small and sometimes only one person is responsible for the DB. The traditional roles of the DBA do not take into account needs that are specific to small businesses and the new DBA roles that the modern DBA is responsible for. Craig S. Mullins took a broader approach to defining the roles of the DBA and did so in the context of the changing technological environment.

Mullins (2001c) noted several factors that the manageability of a database was dependent on; the individual environment (hardware, software, DBMS, applications, etc.), staffing levels, availability requirements (e.g. 24x7 vs. batch window), concurrent workload requirements, availability of DBA tools, and the overall software budget (¶ 9).

Mullins wrote three articles about the issues and concerns of the modern DBA. Mullins (2001b) stated, "administering and managing data objects is the traditional and well-defined role of the DBA" (¶ 10). However, Mullins (2001a) pointed out that DBs and DBMSs grow over time. The growth of these tools was due to several factors. The first factor that Mullins (2001a) stated as the cause for growth in DBs and DBMSs was that DBs are storing more complicated data such as video, images, and audio. The second factor Mullins (2001a) noted was that business needs for data of different types were increasing. The third factor that Mullins (2001a) recognized was that recent DBs were more than just data, they were storing procedures that acted on the data such as stored procedures, triggers and user-defined functions (UDFs). The fourth factor that Mullins saw changing in the DB environment was that DBs were being placed on new platforms like mainframes, midranges, workstations, PCs, and PDAs.

The factors that Mullins observed increasing the growth of the DB and the DBMS also increased the complexity of the DBA's job. Mullins created a new type of DBA in each article that addressed the growth concerns. The three new roles that he developed were, the e-DBA in part 1, the procedural DBA in part 2, and the personal digital assistant (PDA) DBA in part 3. The role of the e-DBA was to integrate the database with the Web. The role of the procedural DBA was to be responsible for programming and debugging involved with triggers, UDFs and stored procedures. The role of the PDA

DBA was to manage development of PDA databases and handle the synchronization of data issues between the DB and PDAs. Along with the new roles that have been added to the job of the DBA, DBAs also have to handle a changing environment.

Mullins (2001c) added the following skills to the traditional roles of the DBA.

> Integrating database applications with the Web.
> Incorporating logic into the database using triggers, UDFs, and stored procedures.
> Storing and manipulating large and complex types of data such as multimedia data.
> Managing data transfer from intermittently connected devices.
> Dealing with rapidly changing technology and products. (¶ 23)

Mullins (2001c) noted, "studies have shown that mid- to large sized organizations have from three to ten different DBMS products" (¶ 17). Each system added to the environment would increase the level of complexity to the DB environment and to the job of the DBA; Mullins called this phenomenon heterogeneity. Mullins (2001c) also discussed another obstacle to effective DB management that he called, "the speed of change." Mullins (2001c) said that organizations could not adopt new DBMSs as quickly as the vendors can create them, and he further noted that organizations ran older versions of DBMS because a great effort is involved in migrating and testing new systems.

The role and environment of the university press DBA differs from the scenarios presented in the literature. The university press DBA is likely to oversee most of the functions of the DB and therefore the university press DBA does the combined work of the DBA, the DB designer and DB programmer. The university press DBA generally works in environments that are small to medium sized rather than the large ones often described in the literature. The number of DBMSs used by university presses will increase the complexity of the DBAs' job and the skill level needed for university press DBAs.

Another important aspect of the DB environment is data quality. Attention must be given to data quality because incorrect data is misleading. Poor data quality can also be a sign of larger problems in the database.

Redman believed that data quality was at the root of many reengineering projects. Redman (1998) stated, “one way of looking at many reengineering projects is that they aim to put the right data in the right place at the right time to better serve the customer” (p. 81). He believed that the awareness of the effect of poor data quality is needed before the problem can be resolved. As Orr (1998) phrased it, “data quality is the measure of the agreement between the data views represented by an information system and the same data in the real world” (p. 67).

Redman divides his analysis of data quality into two broad categories: typical issues and typical impacts. Redman (1998) categorized the typical issues of data quality as follows: issues associated with data views, issues associated with data values, issues associated with data presentation and privacy, security and ownership issues. Redman stated, "unless an enterprise has made extraordinary efforts, it should expect data (field) error rates of approximately 1-5%" (p. 80).

Redman also discusses the impact of poor data quality. He organizes the impacts into three categories: the impact on operations, the impact on the technical level, and the strategic impact. Redman (1998) concludes that poor data quality leads to increased customer dissatisfaction, increased operational costs, less effect decision-making and the reduced ability to make and execute strategy (p. 80).

Redman's work provides a framework that can be used to analyze the errors that are encountered in small businesses information systems. He produced three categories in

which data quality problems can be placed: data views, data values, and data presentation. Redman's work does not offer a standard way of routinely measuring data quality and offers no method for comparing different error rates. If this study reveals that data quality is a factor that causes many presses to reengineer their DBs then this could indicate a need to improve the awareness of data quality in university presses.

Orr (1998) used a feedback control system model (FCS) to draw two conclusions about information systems (p. 67). Orr believed that information systems are developed as part of larger frameworks and that information systems without the FCS model were difficult to control and did not translate easily to the real world.

From the FCS model of information systems, Orr (1998) deduced the following set of data quality rules:

> DQ1. Unused data cannot remain correct for very long;
> DQ2. Data quality in an information system is a function of its use, not of its collection;
> DQ3. Data quality will ultimately, be no better than its most stringent use;
> DQ4. Data quality problems tend to become worse as the system ages;
> DQ5. The less likely some data attribute (element) is to change, the more traumatic it will be when it finally does change;
> DQ6. Laws of data quality apply equally to data and metadata (the data about the data). (p. 68)

From the data quality rules, Orr (1998) developed use-based data quality programs with the aim of improving data quality. Use based data quality audits answer the following questions:

> What data are we interested in?
> What is the data design?
> What is the data model?
> What is the metadata?
> How is the data used today?
> Who uses it?

> For what purposes is the data used?
> How often is the data used?
> What is the quality of the data?
>
> What is in the database?
> How does it compare with the current data in the real world?
> How current is the data? (p. 70)

Orr used statistical sampling to conduct data quality audits. He believed that by using a sufficient sample a meaningful conclusion could be drawn about the data quality of DBs.

Orr's work has several meaningful implications for this study. Orr's FCS model and data quality rules should apply to the data inside of small business databases. His principles state that over time the data will atrophy and that for data quality to remain high the information must be used. Orr's questions provide good examples of questions that can be asked on the survey and in the interviews. The questions in the surveys and interviews will address data quality indirectly by exploring what data is inside the DB, and how that data is used. For this study the questions need to address the functions of the DBA, how the DB is used, how the data functions in the press environment and what procedures DBAs have to deal with problems and changes that are necessary.

## 3. Data Collection

### 3.1 The Survey

The goal of the data collection was to gather information about the environment in which DBAs of university presses work, and their background training. The study used two data collection methods: an email survey and follow-up interviews.

As Babbie (2001) noted, surveys have many advantages, including: surveys can be administered to large populations, they are inexpensive to conduct, operational

definitions can be developed from survey results, and the data collected are in standardized format (p. 268).

However, surveys also have several weaknesses. Babbie (2001) outlined the weaknesses of surveys by saying: surveys are inflexible when it comes to follow-up questions, they require questions to be standardized and therefore may restrict respondents' answers, every survey question may not be applicable to every respondent, and the respondents answers to the question may differ from their actual behavior (p. 268).

The email survey asked what DBMSs university presses were using, what type of OSs the presses had, the tasks that the DBA completed as part of daily work and the education and training background of the DBA. The survey is shown in Appendix A.

Questions one through four of the survey were designed to get a picture of the DB environment of the press and the tasks performed by the DBA. Questions one and two of the survey ask the respondents to identify all the different DBMS software that their university press uses currently and has used in the past. Question three of the survey asks what OSs the press uses. The OSs of the press will limit the type of software they are able to use. Question four collects information on the major tasks that university press DBAs perform. After collecting this information, similar tasks will be grouped together into functions and these functions could suggest useful additions to DB software functionality.

Questions five through ten were designed to gather data about the experience of the DBA in the university press environment. Questions five and six collect data about how many years of experience the participant has in the current and previous jobs. Questions seven, eight and nine ask about the participant's education and degree(s).

Question ten asks the respondent to list the formal training related to DB management he or she has received.

Question eleven asks the respondent if he or she would be interested in helping us further with the study by participating in an interview or more in-depth online survey.

**3.2 The Interview**

The second part of the data collection consisted of semi-structured interviews, to follow up on the initial surveys. Babbie (2001) noted that semi-structured interviews have several advantages over survey methods. Semi-structured interviews reduce the number of "not applicable" answers, they allow respondents to the ability to provide detailed examples, interviewers can explain confusing questions, and in face to face interactions the interviewer can observe respondents while asking questions (p. 267). The follow-up interviews were conducted to collect examples, explanations, and richer descriptions of the life of a DBA in the university press. The interview questions are shown in Appendix B.

Questions one, two, and three of the interview are designed to collect information about the tasks that the DBA performs. Question one is a general question about all the tasks performed on a typical day. Question two asks the DBA about specific tasks that are done daily, weekly and monthly. Question three asks the respondents to specify the major tasks they perform.

Next, question four asks the DBA about ongoing projects the press has that are related to the DB. This question was designed to collect information about large tasks that could not be completed in a day, week or month.

Question five asks respondents to identify the users of the DB. This question was designed to collect information about an important group of stakeholders in the DB and to lead into how the DB is used.

Question six asks about the OSs the respondent marked on the survey and asks them to explain the history behind the different systems (if any) of the press.

Questions seven through ten deal with DB functionality. These questions collect data on the functions of the DB, on what functions the DB lacks, and on what functions people would like to add. These questions were designed to collect data on the work people complete with the DB and how users compensate for functions the DB lacks (if any).

Questions eleven through sixteen deal with changes that are made to the DB. Questions eleven and twelve ask if the users ask the DBA to change the DB and if so, what those users' roles are in the university press. These questions collect information on the user population and on how design changes are influenced by the user requests. Questions thirteen and fourteen ask about the most recent change the DBA has made and ask him or her to go through the process of how the change was made. These questions collect information about the types of changes that have been made to the DB and the processes used to implement the changes. Questions fifteen and sixteen ask the DBA about major changes the database has undergone within the past year and changes that are planned within the next year. This information would indicate current problems the DBAs were trying to solve and plans to address the future needs of the university press.

Question seventeen asks, "What data does the DB hold?" This question was designed to get an overview of the database.

Questions eighteen through twenty-one pertain to system documentation. These questions were designed to see if there is documentation, what pieces of the system are documented, if the documentation is up-to-date and if people consult the documentation. Documentation is often neglected, however it is important for continuity as personnel changes. Out-dated documentation may be worse than no documentation at all because it is misleading.

Questions twenty-two and twenty-three are designed to collect information about problems with the DB. Questions twenty-four and twenty-five are designed to collect information about the likes and dislikes of the current system.

Question twenty-six was designed to give the participant a chance to offer additional comments.

**3.3 Sample**

A list of all the university presses in the United States was compiled from the Association of American University Presses website: *http://aaup.uchicago.edu/*. After visiting the websites of all the university presses, email addresses from the staff information pages were selected in order to contact the organization. The people on the email list were contacted and asked to identify their DBA or the person responsible for their DB (see Appendix C). After two weeks reminders were sent out that included the actual body of the survey.

In all, twenty-eight people representing twenty-eight university presses responded to the survey. Of those twenty-eight, the director of one press responded that there was no DBA, so that press was not included in the analysis. Another company submitted the work for the DB to a department of the parent university. The assistant to

the director responded to the first three questions of the survey. The respondent said, "Much of the information that needs to be done (add / delete users, recover lost data, training, updating/adding system functions, etc) are all done through our Computer Services Department (CSD). My role in this area is to submit the work order to CSD and they complete the work." The data from this respondent should be valid because of the role he or she plays with respect to CSD.

One question on the initial survey asked if participants would like to participate further in the study. The people who indicated yes were contacted by email to arrange an interview. The interview letter obtained prior consent from the participants and provided them with a list of interview questions. The interview letter allowed the participants to schedule the interview for a time that was convenient to their schedule. We arranged face-to-face interviews for local university presses and telephone interviews for those at a distance. The interviews focused on the concerns that were expressed in the responses. Notes were taken at the interview, and then coded to identify important themes. The interviews lasted about one hour each.

**4. Results**

Seventy-one letters were sent out to the presses to identify DBAs, 37 presses responded to the initial letter and 37 surveys were sent out. Twenty-eight people responded to the survey and one person was dropped from the analysis. Five people were interviewed. The response rate for the initial letter to identify the person responsible for the DB was 52.11%. The response rate for the survey was 39.42%. Average data from surveys suggest expected response rates to be around 15-20%. The response rate for this study may have been higher due to the nature of the organization. University presses use

mailings for advertisements and therefore may have been more inclined to respond to the survey.

### 4.1 Survey Results

Table 1 shows the number and percent of presses that currently use each DBMS shown and the ranking of each. Cat's Pajamas was pulled from the "other" category because it was mentioned frequently.

**Table 1. DBMSs currently used by presses**

| Survey Question 1 | DBMS | Number of presses | Percent of presses |
|---|---|---|---|
| What database software does your company use? | | | |
| | Filemaker | 19 | 73.08 |
| | Access | 7 | 26.92 |
| | Other[a] | 7 | 26.92 |
| | Microsoft SQL Server | 4 | 15.38 |
| | MySql | 3 | 11.11 |
| | Cat's Pajamas[b] | 3 | 11.54 |
| | Oracle | 2 | 7.69 |
| | DB2 | 0 | 0.00 |
| | PostgreSQL | 0 | 0.00 |

*Note*. The values represent the total number of presses for each DBMS. Twenty-six out of twenty-eight presses responded to this question. Presses can appear in more than one DBMS program category.
[a] "Other" represents DBMSs that were mentioned by only one press.
[b] Extracted from the "Other" category due to high frequency.

Table 2 shows the DBMSs the press used in the past and the ranking of each. Three DBMS were extracted out of the "Other" category for this question; they were Q&A, Cat's Pajamas, and DBaseIII+. Two respondents also indicated they had not used any other system in the past as shown by the "None" response category.

The information from questions one and two indicate that presses use a wide variety of DBMSs to handle the operations of the press. This is supported by the "Other" category ranking third in the first question and second in this question. The number of frequently mentioned DBMSs has also decreased. The disappearance of the "None" category from current usage also shows that two out of the twenty-seven presses have recently adopted DBMSs. The ranking shows that Filemaker and Access are the most commonly used DBMSs of university presses in this survey.

**Table 2. DBMSs used by presses in the past**

| Survey Question 2 | DBMS | Number of presses | Percent of presses |
|---|---|---|---|
| What software has your company used in the past? | | | |
| | Filemaker | 15 | 57.69 |
| | Other[a] | 8 | 30.77 |
| | Access | 5 | 19.23 |
| | Q&A[b] | 4 | 15.38 |
| | Oracle | 3 | 11.54 |
| | MySql | 3 | 11.54 |
| | Microsoft SQL Server | 2 | 7.69 |
| | Cat's Pajamas[b] | 2 | 7.69 |
| | DBaseIII+[b] | 2 | 7.69 |
| | None[b] | 2 | 7.69 |
| | DB2 | 0 | 0.00 |
| | PostgreSQL | 0 | 0.00 |

*Note*. The values represent the total number of presses for each DBMS. Twenty-six out of twenty-eight presses responded to this question. Presses can appear in more than one DBMS category.
[a] "Other" represents DBMSs that were mentioned by only one press.
[b] Extracted from the "Other" category due to high frequency.

Table 3 shows what operating systems (OS) the presses used. Twenty-eight out of twenty-eight presses responded to this question. This data showed that the university presses in the survey used Windows® and Macs most frequently, there was little difference between the two.

**Table 3. Operating Systems used by presses**

| Survey Question 3 | OS | Number of presses | Percent of presses |
|---|---|---|---|
| What OS does your company use? | | | |
| | Windows® | 22 | 81.48 |
| | Macs | 21 | 77.78 |
| | Windows® / NT | 14 | 51.85 |
| | Unix | 6 | 22.22 |
| | Linux | 3 | 11.11 |
| | Other[a] | 3 | 11.11 |

*Note*. The values represent the total number of presses for each OS. Twenty-seven presses responded to this question. Presses can appear in more than one OS category.
[a] "Other" represents OSs that were mentioned by only one press.

Table 4 combines the current DBMS information from question one and the OS information from question three. Data from respondents that did not respond to both questions were omitted. The horizontal axis (*X*) displays the number of database systems. The vertical axis (*Y*) displays the number of operating systems. Each cell represents the total number of presses that have *X* database systems, and *Y* operating systems. The totals at the end of the columns represent the number of presses that have *X* DBMSs and the totals at the end of the rows represent *Y* OSs.

Table 5 further analyzes the data from question three. Each cell represents the number of the presses that have the combination of OS types. For example, three presses operated only Windows® and six presses had a Windows® and Macs environment.

## Table 4. Matrix displaying number of presses with the number of database systems and operating systems they use

| Number of Operating Systems | Number of Database Systems: 1 | 2 | 3 | 4 | 5 | Total OS |
|---|---|---|---|---|---|---|
| 1 | 3 | 2 | 0 | 0 | 0 | 5 |
| 2 | 9 | 1 | 0 | 0 | 0 | 10 |
| 3 | 3 | 1 | 0 | 0 | 0 | 4 |
| 4 | 1 | 1 | 0 | 1 | 1 | 4 |
| 5 | 0 | 1 | 1 | 0 | 1 | 3 |
| Total DB | 16 | 6 | 1 | 1 | 2 | |

*Note*. This data was calculated from a total twenty-six presses.

## Table 5. Combination of Operating Systems presses have

One OS

| List of systems | Windows® | Macs |
|---|---|---|
| Number of presses | 3 | 2 |

Two OS

| List of systems | Windows® / Mac | NT / Macs | Windows® / NT | Windows® / Other |
|---|---|---|---|---|
| Number of presses | 6 | 2 | 1 | 1 |

Three OS

| List of systems | Windows® / NT / Macs |
|---|---|
| Number of presses | 4 |

Four OS

| List of systems | Windows® / NT / Mac / Unix | Windows® / NT / Macs / Linux |
|---|---|---|
| Number of presses | 3 | 1 |

Five OS

| List of systems | Windows® / NT / Mac / Linux / Other | Windows® / NT / Macs / Unix / Linux |
|---|---|---|
| Number of presses | 2 | 1 |

*Note*. This data was calculated from a total of twenty-seven presses.

The results show that the majority of the DBAs deal with a multiple DB and/or a multiple OS environment. The survey data show that university presses used the Windows® and Macs most frequently. All of the environments with three or more operating systems had Windows® and Macs as two of their OSs. For presses with two operating systems all presses used either Windows®, or Macs. Filemaker was the most used database. If we were to describe the typical press environment, it would have a Windows® and Macs environment and the database system would be Filemaker.

Table 6 shows that DBAs performed tasks over a wide spectrum. The two most common tasks are updating or adding system functions and user account additions or deletions.

**Table 6. Ranking DBA tasks**

| Survey Question 4 | Task | Number of DBAs | Percent of DBAs |
|---|---|---|---|
| Major tasks performed as an administrator | | | |
| | Updating / Adding System Functions | 22 | 81.48 |
| | User account adds / deletes | 19 | 70.37 |
| | Recovery of lost data | 18 | 66.67 |
| | Training | 17 | 62.96 |
| | Documentation | 14 | 51.85 |
| | Other[a] | 10 | 37.04 |

*Note*. The values represent the total number of DBAs that complete each task. This data was calculated from a total of twenty-seven DBAs.
[A]"Other" represents tasks that were mentioned by only one DBA.

Table 7 displays the years of experience the participants have with their current organization and Table 8 shows the experience that the participants had with other organizations.

**Table 7. Years of experience with this organization**

| Survey Question 5 | Years of experience | Number of DBAs | Percent of DBAs |
|---|---|---|---|
| Years of exp. | 1-2 years | 6 | 23.08 |
| | 3-5 years | 4 | 15.38 |
| | 6-10 years | 3 | 11.54 |
| | 11-15 years | 8 | 30.77 |
| | >16 | 5 | 19.23 |

Note: This data was calculated from a total of twenty-six DBAs.

**Table 8. Years of experience with other organizations**

| Survey Question 6 | Years of experience | Number of DBAs | Percent of DBAs |
|---|---|---|---|
| Years of exp. with other organizations | | | |
| | 0 and N/A[a] | 9 | 37.50 |
| | 1-2 years | 3 | 12.50 |
| | 3-5 years | 4 | 16.67 |
| | 6-10 years | 2 | 8.33 |
| | 11-15 years | 2 | 8.33 |
| | >16 | 4 | 16.67 |

Note: Twenty-four DBAs responded to this question.
[a]The 0 and N/A data were combined to represent the DBAs that had not worked at other organizations.

Table 9 shows the education levels of the participants. Twenty-seven DBAs responded to this question. Over 80% of the participants have 4-year university education or more.

Question eight of the survey asked if the participant had a degree related to DB management. Twenty-one out of twenty-five participants indicated no and 4 participants

indicated yes. The majority of the participants did not have a degree that was related to DB management.

**Table 9. Education level of DBAs**

| Survey Question 7 | Education | Number of DBAs | Percent Of DBAs |
|---|---|---|---|
| Highest level of education | 4 year university | 11 | 42.30 |
| | Graduate | 10 | 38.46 |
| | Community College | 2 | 7.69 |
| | Other[a] | 2 | 7.69 |
| | High School | 1 | 3.84 |

*Note*. The values represent the total number of DBAs that complete each level of education. This data was calculated from a total of twenty-seven DBAs.
[a] "Other" represents education levels that were mentioned by only one DBA.

Question ten of the survey asked the participants if they had sought other formal training. Eighteen out of twenty-five participants indicated no and seven participants indicated yes. Seventy-two percent of the participants did not receive other formal training. Table 10 shows the formal training that was listed by participants answering yes.

**Table 10. Other formal training**

| |
|---|
| Unix Administrator, Sysbase DBA, Oracle DBA |
| 2 day intensive filemaker training course |
| classes at local community college self taught |
| microsoft accessing training and some college computer courses |
| netware certified novell administrator |
| Novell Network Administration 2.15 |
| W2K SERVER AND PRO |

The data from the survey show that DBAs ranked addition and deletion of user accounts as the number one task performed. The majority of the DBAs surveyed had 11-

15 years of experience. This indicates that most of the respondents have worked with university presses for some time. When asked about years of experience with other organizations, the majority of DBAs responded they had zero years with other organizations or the question was not applicable. This response could mean that this was the respondents' first job, or that they had never worked as a DBA before. DBAs of university presses were highly educated, but most of the respondents also indicated they had not received other formal training related to their job.

### 4.2 Interview results

#### University press computer systems

Question number six of the interview was designed to inquire into the history behind the OSs and the computers that the different university presses used. Two DBAs indicated that the parent university gave the press the PCs that the press owned; other DBAs did not indicate how they received the computers. Two DBAs in the interview said some users in the press preferred Macs and others preferred Windows®. Probably the largest determining factor in the hardware was the work that the university press completes. One DBA said, “80% of the people use Macs. They are best for design and productions needed to store files.” DBAs listed several different reasons for Mac hardware claiming “Macs offered better design packages and graphic functions” or “were the better buy in terms of computing power.” The comments indicated that presses used Macs because of the graphic programs. The computer environment of the press developed from the systems the press could afford and from the systems that DBA could support.

Two DBAs said the Filemaker system had started as a personal project of one person and then the entire press adopted the system.

**Data and functionality**

The main data that the DBs contained consisted of mailing addresses, wholesaler information, retailer information, books, journals, authors, professional meetings and organizations.

DBAs mentioned that their DBs performed the normal DB functions of storing, exporting and entering data. The DBs of most presses were used to track the life cycle of a manuscript or journal from start to finish. It was also used to track information related to the book such as graphics, and brochures and advertisements that might be used in promotions.

One DBA's DB had different functions than the others, focusing instead on book sales data, cash flow information, and consumer purchasing behavior. This DBA indicated that there were not any features that needed to be added.

**Users of the database**

The size of the presses the DBAs worked at varied, however the users of the database remained similar across presses. DBAs often viewed users of the DB by department. Among the departments listed were: Acquisitions, Marketing, General Admissions, and Production. The staff positions and departments varied by press. For instance, "assistant to the director" and "web designer" were jobs titles that could be part of other positions or not exist entirely. Two DBAs listed interns as users of the database.

Two DBAs said that users ask them to make changes to the database. Two others indicated they themselves drove the changes that were made to the database. The origin

of changes to the DB seemed to differ by press depending on the business model. In one press, anyone could ask for a change to be made to the DB, but the change had to be approved by the department that used the form. No one else mentioned a formal approval process.

**Features users requested**

The users of the DBs requested to see new reports, new fields, and new features. If the DB did not have a required function the users completed the work manually, or they used other systems to complete their work. For example, email could be used for addresses, or reports could be generated in Microsoft Excel. In two cases, departments had databases that were specific to that department.

**DBA tasks**

DBAs listed designing new layouts, DBs, scripts and fields, as some of the major design tasks that they performed. Two DBAs mentioned troubleshooting problems that occur with the DB and planning for upgrades and installations of new hardware or software. Three DBAs said that work scheduling was reactive, requiring them to respond to the immediate needs of the users. Tasks that the DBAs performed during a typical day included checking email, checking status of back ups, checking webservers, and performing updates to DBs.

Three DBAs described compiling data for monthly sales reports. Two DBAs indicated they updated web pages and performed web administration.

**Features DBA wanted**

The DBAs mentioned several features they would like to add, including online documentation, ability to match duplicate records and eliminate them, and the ability to

coordinate books bought to customer address to determine what purchases a person made. The DBAs also wanted to change logical schema so that journal data was supported in addition to book data, add a relationship to the DB to differentiate between editors, illustrators and authors, and create a royalty form that would automatically calculate sales.

One feature and also a serious problem that a DBA mentioned was that he or she would like the ability to run queries and sort data on the Appleworks DB the press used to keep data about names.

**Problems, likes, and dislikes of the system**

Two DBAs did not like the use of the word "problem." Instead, they said that, "the database has not achieved its potential" or "it hasn't taken advantage of the opportunity."

One DBA wanted access to the source code in order to fix the language so that the interface would work. This same DBA did not have the ability to run queries and sort data and coincidentally was one of the DBAs who mentioned they didn't like to use the word "problem." One DBA said that parts of the system were not up-to-date and had grown beyond the use of specific departments. This was because he or she had inherited a bad table structure. One said that titles were not up-to-date and they needed to be more accurate. The logical model of the DB had changed in this case. The title field was not important in the old model; with the change, it was crucial to have correct data.

In general, the DBAs liked simplicity and liked systems that worked. This aspect was important to one DBA because he or she had no formal training. This DBA mentioned gaining experience from online discussion boards and the community of users

on the Internet. The DBAs also liked how the database made tasks user friendly with program scripting. One DBA called the system "idiot proof."

The dislikes that the DBAs had seemed to be related to the job experience they had as a DBA. The same DBA, who said the DB was not up-to-date, did not like the table structure and the user interface of his or her DB. Again, this was because he or she disliked the system that they inherited. One DBA did not like the technical manuals; this DBA had mentioned he or she had no formal training. The other dislikes mentioned were that the press had grown beyond the limits of the system and the current system was a lot of work to maintain.

**System documentation**

One DBA said the university press had an entity-relationship (ER) diagram and a data dictionary for the current DB. Another had three binders of system documentation: an operations manual, an applications manual, and a file manual. The other three DBAs said the documentation was minimal for the DB. All DBAs indicated that few people used the documentation. The people listed as using the documentation were new users, interns, and the DBA. Two DBAs said user manuals were a part of the current documentation. Two DBAs also said documentation of how to export data from the DB was part of the current documentation.

**Changes to the database**

Four of the five DBAs interviewed were in the process of implementing some type of migration. One DBA planned to migrate to a higher version of the Filemaker software. Another planned to buy new software and had explored the possibility of moving to Access but at the time of the interview was not sure. The third planned to

redesign the DB and the fourth DBA was migrating from Filemaker to SQL server. The fifth DBA did not plan any major changes over the next year.

Other ongoing projects highlighted the normal tasks of the DBA. Those tasks were adding to the documentation, finding and removing duplicate records, and adding fields, reports, and views. Two special projects were mentioned: one DBA wanted to get two DBs to communicate with Object Database Connectivity (ODBC), and another wanted to add advertising pamphlets and other images to the database.

**Migration and reengineering**

Two DBAs indicated that they planned to buy new software in the near future. Another indicated the system would be rebuilt within a year but was uncertain as to what software the new system would be on. Another indicated the present DB was in the process of being migrated to different software. For the DBAs that were migrating and reengineering, documentation would be built with the new system.

Press DBMSs are in need of migration and reengineering because software improvements can increase productivity. The reason for reengineering is to make better use of existing data. The press environment has changed over time and so press DBMSs need to be updated to keep up with the changes.

**5. Conclusions**

Mullins (2001c) stated that mid- to large-sized organizations have three to ten different DBMSs. The presses in this study show that the majority of presses rely on one DBMS but the range of DBMSs used varied from one to five DBMSs per press. Issues of data quality did not surface during the interviews with a high frequency. Only one press mentioned the desire to reduce duplicate records. Of the seven tasks mentioned in the

work by Kreines and Laskey (1999) three appeared with high frequency: security, software maintenance and operation, and tuning and troubleshooting. The security tasks that DBAs had to complete were addition and deletion of user accounts. The software and maintenance tasks the DBA had to complete were software installations and upgrades. The tuning and troubleshooting tasks the DBA had to complete included adding new fields, new layouts, new relationships, and checking the status of backups.

In analyzing the results of this study, trends began to develop in the survey answers and in the interviews. The largest trend that appeared was the lifecycle of the DB and how different administrators handled the problems that arose concerning new fields, new formats, and updates. The fact that four out of five presses were in the process of some type of migration may be an indication that many presses are going through a period of transition. The data from this study highlights the issues of organizations going through redesign processes. Future work may involve investigating how and why changes are made to the DBs at university presses. More work could also be done to investigate changes in DB management and how these changes relate to the specific needs of university presses and other small businesses. A future study would continue to build upon information about the software that presses use and the problems that DBAs have with administration of systems in the university press environment.

Another trend that this study revealed was the importance of mailing functions and addresses to the university press DB users. These features focus on tracking letters and correspondence with vendors, retailers and professional organizations. At the core of this function is information sharing between departments, other presses, and between presses and suppliers. Added functionality to the DB would enhance this feature. One

person indicated that email integration was one goal they hoped to achieve with a redesign. With email integration, the press could reduce the amount of physical mailing necessary and costs could be greatly reduced.

The idea of information sharing extends to the ability to connect to information outside the press office. It also extends to reducing replication of common information. One person interviewed stated that each press had a DB of vendors. By sharing the vendors' addresses among themselves, the community of presses could reduce cost and time maintaining the information.

The interviews revealed that it was important to export and massage data so that it can move between systems. This indicates that the DB has overhead when communicating with other DBs or with other programs. For example, many of the presses export monthly financial reports to determine how certain books are doing. Presses also export mailing addresses from the DB so they can produce mail labels. This poses the question, how does data get from system to system? Ways to facilitate transfer of information from the DB are needed. When data is exported to create physical lists or labels, they must be formatted. Are there existing programs to ease this data transfer? Are presses using them? If not, why not?

The focus of much of the literature currently is toward expansion and towards handling larger data and the predicted growth of DBs. The people who design DBMSs or as Elmasri and Navathe (2000) would say, the "workers behind the scene," also need to address the complex environments in which small businesses design DBs. There is a market need for automation of DBA tasks and for the DBMS software to ease the burden of the DBA in both large and small organizations. Mullins clearly outlined the software

requirements that DBAs of the future will have. Mullins (2001c) said, “the software should be able to intelligently monitor, analyze and optimize applications using past present and future analysis of collected data” (¶ 25). The DBMS of the future could help to augment the documentation of the DB system and migration of out-dated DBs to new systems. In small businesses, the staff is small and there is no one else to share the increased responsibility, so the burden must be placed back on the “workers behind the scene” to develop better tools at lower costs.

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# Appendix A:
# Database Software and Practices Survey

Hello,

You have been chosen to participate in a research study of database usability for university presses. Ron Brown, a master's student from the University of North Carolina School of Information and Library Science, is the principal investigator of this study.

I am conducting this study as part of my research to complete the master's paper requirement of the School of Information and Library Science. The purpose of this study is to collect information about the database environment of university presses around the country. The data collected will be used to analyze trends in usage of database software. I hope to gather information that can be used to improve databases and to better address the needs for university presses.

Enclosed with this letter is a brief questionnaire that asks a variety of questions about your database software, how it is used at your company, and some information about you. I am asking you to look over the questionnaire and, if you are willing to participate in the study, complete the survey and send it back to me by email.

To respond, you can simply reply to this message. A copy of the survey is provided in the body of this email message and as a MS Word attachment. First, choose which survey format you would like to respond with. If you use the survey that is in the body of this message, copy the entire survey into the reply message, and then mark your answers directly into the survey. If you are using the attachment, open the attachment and mark your answers directly into the survey. When you send the form, please check to make sure the survey questions are included and that you have not omitted any questions.

I hope that you will take the time to complete this questionnaire and return it to me. The results of this project will be summarized and presented to the School of Information and Library Science as a Master's paper. Participation is voluntary and there is no penalty if you do not participate. I guarantee that your responses will not be identified with you personally.

If you have any questions regarding the study, please contact Ron Brown at browr@ils.unc.edu or faculty advisor Dr. Stephanie Haas, haas@ils.unc.edu at CB# 3360, 100 Manning Hall, UNC-CH, Chapel Hill, NC 27599-3360, (919) 962-8360.

Institutional Review Board Approval:

The Academic Affairs Institutional Review Board (AA-IRB) of the University of North Carolina at Chapel Hill has approved this study.

If you have any concerns about your rights in this study you may contact the Chair of the AA-IRB, Barbara Davis Goldman, Ph.D., at CB# 4100, 201 Bynum Hall, UNC-CH, Chapel Hill, NC 27599-4100, (919) 962-7761 email: aa-irb@unc.edu

Your Privacy is Important:
§ We will make every effort to protect your privacy.
§ We will not use your name in any of the information we get from this study or in any of the research reports.
§ The information recorded with this survey will be coded according to participant's name, email and location.
§ When the study is complete the key that matches the code number and name information will be destroyed.

Risks and Discomforts:
§ We do not know of any personal risk or discomfort you will have from being in this study.

Your Rights:
§ You decide on your own whether or not you want to be in this study.
§ You will not be treated any differently if you decide not to be in the study
§ If you decide to be in the study, you will have the right to stop being in the study at any time.
§ You do not have to answer any specific questions that you do not want to.

Thank you,

Ron Brown

---

Database Software and Practices Questionnaire:
INSTRUCTIONS: To respond, you can simply fill out the answers by placing an X next to the answers that most closely describe your experiences. Check all that apply. Please type in the answer for questions that request more information. Next, reply to this message including the answers with "Database Software and Practices Questionnaire " in the subject heading.

1. What database software does your company use?

____ Filemaker ____ Microsoft SQL Server ____ Oracle ____ MYSQL ____ Access ____ DB2 ____PostgreSQL
____ Other (Please list: _____ )

2. What software has your company used in the past?

____ Filemaker ____ Microsoft SQL Server ____ Oracle ____ MYSQL ____ Access ____ DB2 ____PostgreSQL
____ Other (Please list: _____ )

3. What type of operating systems does your company use?

____ Windows ____ Windows/NT ____ Mac ____ Unix ____ Linux
____ Other (Please Specify: _____ )

4. What are the major tasks that you perform as an administrator?

____ Documentation of the current system (E.g. ER models, Schemas, Training Manuals)
____ User account adds and deletes ____ Recovery of lost data
____ Updating / Adding System Functions ____ Training
____ Other (Please list: _____ )

5. How many years of experience do you have with this organization? ____

6. How many years of experience do you have in similar jobs with other organizations? ____

7. What is the highest level of education you have received? (If you are currently pursing a degree mark it with an X as the highest.)

____ High School ____ Community College ____ 4 year University
____ Graduate ____ Other

8. Have you obtained a degree related to database management?

____ Yes ____ No

9. If so what degree?

(Please list. e.g. Master of Information Science, Master of Library Science, Computer Science…)
_____

10. What other formal training have you had?
(Please list. e.g. Oracle certification, other licenses or certificates)
_____

11. Would you be interested in assisting us further with this study by participating in an interview or a more in-depth online survey? If yes, I will contact you shortly to arrange the interview.
____ Yes ____ No

Thank you for taking the time to complete our survey. To submit your responses, please hit the send button. (Make sure the survey questions and your answers are included in the reply.)

Again, if you have any questions regarding the study, please contact Ron Brown at browr@ils.unc.edu. If you have any questions about your rights as a research participant, you can email the Academic Affairs Institutional Review Board at aa-irb@unc.edu.

_____

## Appendix B:
## Letter to Schedule Interview

Hello

Thank you for participating in my survey. In your survey response to the Database Software and Practices Questionnaire you indicated that you would be willing to participate in an interview.

I am writing to schedule the interview with you and provide you a list of the questions so that you will have a chance to review them before the date of the interview.

I need you to read the interview consent form and to review the interview questions. If you consent I need you to return the signed form to me along with a phone number to contact you. Please indicate at least three good times for you to participate in the interview.

Again, if you have any questions regarding the study, please contact Ron Brown at browr@ils.unc.edu. If you have any questions about your rights as a research participant, you can email the Academic Affairs Institutional Review Board at aa-irb@unc.edu.

Interview Questions

·Who are the users of the database?
·Who requests changes to the database?
·What process do you go through to make the change?
·Has the database undergone any major changes within the last year? Please describe them.
·What are the ongoing projects?
·What is the extent of the documentation of the current database system?
·What data does the database hold?
·What are the functions of the database?
·What are your major design tasks as an administrator?
·What are the problems?
·What are your likes of the current system?
·What are your dislikes of the current system?
·What functions would you like to add to the current system?
·What functions would your users like to see added to the current system?
·If the database is lacking functionality, what are the ways you compensate for the missing functions?
·What pieces of your system are documented?
·Is the documentation up-to-date?
·Do people ever consult the documentation?

Interview Consent Form

You have been invited to participate in a research study conducted by Ron Brown of the School of Information and Library Science of the University of North Carolina at Chapel Hill.

The purpose of this study is to collect verbal feedback about the database environment of university presses around the country. The data collected will be used to analyze trends in usage of database software. This study hopes to gather information that can be used to improve databases and to better address the needs for University presses.

The interview that you are participating in will take approximately one hour. During that time:
1.With your permission, the interview session will be tape-recorded for data collection. If you would prefer not to have the session tape-recorded, I will take notes during the interview session.
2.You will be asked questions about the tasks you complete and the environment you complete them in.

The questions are designed to reveal trends in the database software practices of university presses. The questions are not designed to test your personal knowledge of databases and software. The data collection is aimed at constructing a user analysis of system administrators / DBAs at university presses.

Your Privacy is Important:
§ We will make every effort to protect your privacy.
§ We will not use your name in any of the information we get from this study or in any of the research reports.
§ The information recorded during the sessions will be coded according to participant's name, email and location.
§ When the study is complete the key that matches the code number and name information will be destroyed.

Risks and Discomforts:
§ We do not know of any personal risk or discomfort you will have from being in this study.

Your Rights:
§ You decide on your own whether or not you want to be in this study.
§ You will not be treated any differently if you decide not to be in the study
§ If you decide to be in the study, you will have the right to stop being in the study at any time.
§ You do not have to answer any specific questions that you do not want to.

If you have any questions regarding the study, please contact Ron Brown at browr@ils.unc.edu or faculty advisor Dr. Stephanie Haas, haas@ils.unc.edu at CB# 3360, 100 Manning Hall, UNC-CH, Chapel Hill, NC 27599-3360, (919) 962-8360.

Institutional Review Board Approval:

The Academic Affairs Institutional Review Board (AA-IRB) of the University of North Carolina at Chapel Hill has approved this study. If you have any concerns about your rights in this study you may contact the Chair of the AA-IRB, Barbara Davis Goldman, Ph.D., at CB# 4100, 201 Bynum Hall, UNC-CH, Chapel Hill, NC 27599-4100, (919) 962-7761 email: aa-irb@unc.edu

I agree that this session can be tape recorded for data collection. (Delete this section if you do not agree.)

_____ (Signature of Participant)
_____ (DATE)

I have had the chance to ask any questions I have about this study, and they have been answered for me.
I have read the information in this consent form, and I agree to be in the study. There are two copies of this form. I will keep one copy and return the other to the investigator.

_____ (Signature of Participant)
_____ (DATE)

Please indicate a phone number where you can be reached and a good time and date for the interview.

_____ Phone number
_____ 1.(Time/Date)
_____ 2.(Time/Date)
_____ 3.(Time/Date)

## Appendix C:
## Letter to Identify DBA

Hello,

I am conducting a study as part of my research to complete the master's paper requirement of the School of Information and Library Science. The purpose of my study is to collect information about the database environment of university presses around the country.

I would like to send an email survey to the database administrator or to the person responsible for the database at your organization. If you provide me with that email I will send the survey to them directly.

The data collected will be used to analyze trends in usage of database software. I hope to gather information that can be used to improve databases and to better address the needs for university presses.

I hope that you will take the time to reply to me. If you provide me with that email I will be able to send out my surveys to the correct people. The results of this project will be summarized and presented to the School of Information and Library Science as a Master's paper. Participation is voluntary and there is no penalty if you do not participate. I guarantee that your responses will not be identified with you personally.

If you have any questions regarding the study, please contact Ron Brown at browr@ils.unc.edu or faculty advisor Dr. Stephanie Haas, haas@ils.unc.edu at CB# 3360, 100 Manning Hall, UNC-CH, Chapel Hill, NC 27599-3360, (919) 962-8360.