WHAT SHOULD UNIVERSITIES BE TEACHING FUTURE END USER LIAISONS ABOUT DATABASE?

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ABSTRACT: One of the facets of the explosion of end user computing, is the increased use of databases in corporations, especially at department, and individual levels. Many businesses have created a special group of front-end liaison staff to assist end users in accomplishing their computing efforts. This study sought to obtain information about what businesses view as their database expertise requirements for MIS staff who work as end users liaisons. In addition, this study sought to determine information on what is currently taught about database in University business programs.

This study is based on responses to 2 questionnaires; one administered to a group of businesses and the other administered to selected universities. Results of this study found that universities having a database course are more likely to offer appropriate education for end user liaisons than those who do not have a database course. Generally, universities do not provide as much mainframe experience as desired by the businesses.

KEYWORDS: Database, End User Support, MIS Liaison Staff, Database Curriculum

INTRODUCTION

Use of databases is increasing at the corporate, department, and individual levels within businesses. There are mainframe databases which are typically controlled and maintained by staff within the MIS (Management Information Systems) function. In addition, there are many PC based databases which may or may not come under the auspices of a formal MIS structure. In fact, these databases are frequently controlled and maintained by end users. Many MIS departments have or are establishing a front-end staff to assist end users in accomplishing their computing efforts. In order to do this, these end user liaisons need a working knowledge of database concepts.

Many businesses have established a new functional area, called an information center, to support the end-user community in utilizing computer resources. The importance of database knowledge for this type of support staff seems to be increasing. "Information center professionals, traditionally the least technical of all computer professions, have to become increasingly conversant in database design and administration." [6, pg. 35] Database related services typically provided by information centers and other end user support groups include help in accessing centralized data, and in designing and creating micro database solutions for business problems. Watson, et al. [10] conclude that personnel in

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these support areas require a different set of skills than regular information systems staff. In their report on skill requirements for end user support personnel, non-technical skills were found to be most important. However, PC packages and database concepts were ranked in the top 8 required skills for this group.

Currently, there is interest in appropriate education for end user support personnel; however, not much is known about specific education needs for these people. Previous research studies have examined what skills employers want new information systems personnel, not end user support personnel, to possess [1, 3, 5, 7]. End user liaison personnel will often have acquired their MIS background, including database, in a university program. While the inclusion of database courses in the ACM and DPMA Model Information Systems (IS) Curricula [8, 4] recognizes the general need for database knowledge, these model curricula have focused on traditional IS personnel rather than end user support personnel.

A question of interest to universities is whether or not what is actually being taught satisfies the educational needs for database expertise of support personnel, especially the perceived needs of business. This paper will review the current database course content in universities. By polling selected companies about database knowledge needs for end user liaisons, information has been obtained on what companies view as necessary working knowledge. By comparing what is needed with what is being taught, this paper will address the question of how close universities are to providing the database expertise needed by future end user liaisons.

DESCRIPTION OF THE STUDY

This study is based on two questionnaire surveys: one for businesses and the other for universities. The business questionnaire solicited information on the database expertise requirements for MIS staff who work as front-end liaisons with end users. The university questionnaire solicited information on the database topics being taught and the amount of time being spent on database, in addition to the database management systems (DBMS) hardware and software environment being used.

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The business questionnaire asked for the following information:

1. The existence of a special group to work as front-end liaisons assisting end users with their computing needs and the educational background of these people.
2. The importance of various database topics for front-end liaisons (see Table 1).
3. The importance of knowledge about a specific DBMS, type of DBMS (mainframe, mini, micro), or model a DBMS is based upon (relational, hierarchical, CODASYL).
4. The level of experience sufficient for a MIS liaison.

The university questionnaire asked for the following information:

1. The existence of a MIS program or concentration and whether AACSB accredited.
2. Data on courses that teach database, whether part of a course or an entire course. The type of data asked for included:
   - Percent of time devoted to database
   - Hardware environment used
   - DBMS software used
   - Database topics covered in each course
   - Types of projects used

The business questionnaire was sent to 87 businesses who were known to have a MIS function. This group included a variety of businesses from local to large international firms. The university group consisted of 47 faculty who taught in a College of Business in the United States or in Canada. Responses to these questionnaires were collected in the fall of 1988.

Results of the university questionnaire were analyzed in terms of

Table 1: Importance of Knowledge of Each Topic as Perceived by Business

Database Topic	Importance of Rating (N-23)
Introductory Concepts	4.6
Logical DB Design	4.5
Physical DB Design	4.3
Relational DB Systems	3.8
Database Administration	3.6
Data Modeling	3.4
SQL	3.4
Expected DBMS Functions	3.4
4th Generation Environment	3.4
Normalization	3.1
Hierarchical DB Systems	3.0
Distributed Database	2.9
CODASYL (Network) DB Systems	2.0

response percentages. The results of the business questionnaire relating to the existence of a special liaison group and to their job and educational experience were also analyzed in terms of response percentages for the number of responses to each question. Responses on the business questionnaire relating to the importance of various items were specified using a 5-point scale. An importance rating was calculated by averaging the individual ratings.

The responses from businesses on topic importance were further analyzed using analysis of variance (ANOVA) and the Tukey-Kramer method of multiple comparisons. Prior to running the ANOVA test, the questionnaire items were grouped into four topic areas of interest: Basic Concepts, Design Topics, Database Environment, and Database Types. The basic concept group was composed of the following 3 questionnaire topics: introductory concepts, database administration, and expected DBMS functions (eg. recovery). The design topics group was composed of the following four questionnaire items: database (DB) design--logical, DB design--physical, data modeling, and normalization. The database environment group was composed of the following five items: forth generation environment, distributed database, a particular type of mainframe DBMS, a particular type of mini DBMS, and a particular type of micro DBMS. The database types group was composed of the following questionnaire items: relational DB Systems, SQL, CODASYL DB Systems, Hierarchical Systems, a specific DBMS, DBMS based on a relational model, DBMS based on a hierarchical model, and DBMS based on a network model.

RESULTS

Results from Business Questionnaire

Twenty-seven businesses responded to the questionnaire giving a 31 percent return rate. Respondents were asked to rate the importance of knowledge about specific database topics for front-end liaison people. Table 1 lists the specific database topics, ordered by the calculated importance rating. Topics indicated as most important were introductory concepts and database design. Of next importance were relational systems and database administration. Normalization, hierarchical systems, and distributed database received low importance ratings. The topic rated least important was CODASYL systems.

Questions were also asked to determine the perceived importance of knowledge about a specific DBMS, the type of machine used, and the DBMS model. Table 2 shows the importance ratings for these questions. Knowledge of a specific DBMS was important. The ratings on type of DBMS showed that mainframe DBMS was most important, micro DBMS was somewhat important, and mini DBMS was not considered important. The importance ratings on type of model upon which a DBMS is based indicated that relational was most important. With regard to having knowledge of the underlying DBMS model, the relational model was important, the hierarchical model only somewhat important and the network/CODASYL model was least important.

Businesses could indicate specific DBMS's that end user liaisons need to know. Fifteen businesses responded with many businesses listing more than one DBMS. Answers were classified by model type; 30 relational packages were listed (including dBASE), 9 hierarchical packages (all IMS) and 2 CODASYL.

Further analysis of the data reported in Tables 1 and 2 was conducted to determine if there was any significant difference among the responses within each of the four special interest topic areas. Tables 3 though 6 give the results of the comparisons that were run for each group.

For the basic concept group of topics, significant differences were found among the means of the three items ($F=8.26$; $df=2,67$; $p = .0006$). The results of the Tukey-Kramer test reported in Table 3 indicate that business's importance rating of introductory concepts is significantly higher ($p < .05$) than for database administrator (DBA) and expected DBMS functions.

In the database design group of topics, significant differences were found among the means of the four items ($F=11.00$; $df=3,89$; $p = .0001$). Further analysis indicated that businesses' importance ratings for logical or physical database design were significantly higher than their importance ratings for data modeling or normalization (Table 4).

In the database environment group of topics, significant differences were found among the means of the five items ($F=7.91$; $df=4,112$; $p = .0001$). As indicated in Table 5 on the following page, the importance rating of the topic, mainframe database management systems, was

Table 2: Importance of Specific DBMS Knowledge as Perceived by Business

Specific DBMS Knowledge	Importance Rating
Specific DBMS (N=23)	3.7
Type of DBMS:	
Mainframe DBMS (N=23)	4.1
Micro DBMS (N=22)	3.2
Mini DBMS (N=22)	1.9
Model DBMS is based on:	
Relational (N=19)	4.2
Hierarchical (N=20)	3.1
Network/CODASYL (N=18)	2.5

Table 3: Difference between Means of the Importance Rating for Basic Concept Topics

Topics	Introductory Concepts	Database Administration	Expected DBMS Functions
Introductory Concepts (Mean=4.636)	--	1.071*	1.202*
Database Administration (Mean=3.565)	-1.071*	--	0.131
Expected DBM Functions (Mean=3.434)	-1.202*	-0.131	--

*Significant difference at P<.05

significantly higher than the rating of the topic, distributed database ($p < .05$). The three topics, mainframe database management systems, fourth generation languages and microcomputer database management systems, were each significantly higher than the topic, minicomputer database management systems ($p < .05$).

Significant differences were found among the means of the eight topics related to database types and models ($F=6.40$; $df=7,172$; $p = 0.0001$). Further analysis indicated that there was a significant difference ($p < .05$) between the lower importance rating given to CODASYL and each of the responses for the following topics: relational model, relational DBMS, specific type DBMS, and SQL (See table 6 on the next page). In addition, there was also a significant difference ($p < .05$) between the two responses to relational model and relational DBMS and the response to network model.

In addition to being asked about the importance of a front-end liaison person having a general knowledge about specific database topics, businesses were also asked about the level of experience this person should have. When asked what level of experience is sufficient for a person filling a position as end user liaison, the most common answers selected were "class with live project" and/or "actual working experience in addition to class experience." Results are summarized in Table 7.

Results from University Questionnaire

Thirty-seven schools responded to the questionnaire giving a response rate of 79 percent. Of the 37 schools, 41 percent are AACSB accredited. About two-thirds (65%) of the schools responding to the questionnaire had either an MIS program or concentration.

The information reported on the coverage of database topics by type of course was analyzed. Twenty-one schools reported having a database course, with 3 schools having 2 database courses. Some database topics were covered in an

Table 4: Difference between Means of the Importance Rating for Database Design Topics

Topics	DB Design Logical	DB Design Physical	Data Modeling	Normal-ization
Design Logical (Mean=4.545)	--	0.241	1.136*	1.415*
Design Physical (Mean=3.304)	-0.241	--	0.895*	1.174*
Data Modeling (Mean=3.409)	-1.136*	-0.895*	--	0.279
Normalization (Mean=3.130)	-1.415*	-1.174*	-0.279	--

Significant difference at P<.05

Table 5: Difference between Means of the Importance Rating for Database Environment Topics

Topics	Particular Type of Mainframe DBMS	4th Generation Environment	Particular Type of Micro DBMS	Distributed Database	Particular Type of Mini DBMS
Particular Type of Mainframe DBMS (Mean=4.130)	--	0.695	0.948	1.260*	2.175*
4th Generation Environment (Mean=3.435)	-0.695	--	0.253	0.565	1.480*
Particular Type of Micro DBMS (Mean=3.182)	-0.948	-0.253	--	0.312	1.227*
Distributed Database (Mean=2.870)	-1.260*	-0.565	-0.312	--	0.915
Particular Type of Mini DBMS (Mean=1.955)	-2.175*	-1.480*	-1.227*	-0.915	--

*Significant Differance at P<.05

Table 6: Difference between Means of the Importance Rating for Database Types Topics

Topics	Rel DBMS Model	Rel DB Systems	Specific DBMS	SQL	Hierarch DBMS Model	Hierarch DB Systems	Network DBMS Model	CODASYL DB Systems
Relational DBMS Model (Mean=4.211)	--	0.385	0.515	0.820	1.111	1.168	1.737*	2.168*
Relational DB Systems (Mean=3.826)	-0.385	--	0.130	0.435	0.726	0.783	1.352*	1.783*
Specific DBMS (Mean=3.696)	-0.515	-0.130	--	0.305	0.596	0.653	1.222	1.653*
SQL (Mean=3.391)	-0.820	-0.435	-0.305	--	0.291	0.348	0.917	1.348*
Hierarchical DBMS Model (Mean=3.100)	-1.111	-0.726	-0.596	-0.291	--	0.057	0.626	1.057
Hierarchical DB Systems (Mean=3.043)	-1.168	-0.783	-0.653	-0.348	-0.057	--	0.569	1.000
Network DBMS Model (Mean=2.474)	-1.737*	-1.352*	-1.222	-0.917	-0.626	-0.569	--	0.431
CODASYL DB Systems (Mean=2.043)	-2.168*	-1.783*	-1.653*	-1.348*	-1.057	-1.000	-0.431	--

*Significant difference at P<.05)

introductory MIS course by 22 schools. Table 8 shows the percentages of schools covering a specific topic by course for all schools who reported topics covered for that particular course.

Introduction to MIS Course

All 22 schools reporting some database coverage in an introduction to MIS course, covered introductory database concepts (see Table 8). The second most frequently covered database topic in the introductory MIS course was database administration. Other frequently covered topics were: logical database design, relational database systems, and fourth generation environment. Normalization and CODASYL database systems were least frequently covered.

The schools were asked to estimate the percentage of time within this course devoted to database. Most schools (48%) spent less than 10% of the course's time on database topics. Thirty- four percent spent from 10 to 15 percent of the course on database, and 17 percent spent more than 15 percent.

Database Course

When the entire course was devoted to database, most schools reported covering all of the topics listed in Table 8. It is interesting to note that while all schools covered logical database design about 14 percent did not cover physical design.

DBMS Environment Used

Although mainframe as well as micro environments were covered in classes, micro based products were used almost exclusively for hands-on practice (see Table 9). In the Introductory MIS course, all of the 19 respondents indicated the exclusive use of relational micro based products.

There was more diversity in both the environment and the DBMS products used for the database course (see Table 9). However, relational micro based products were still the predominant DBMS's used. Eighty-six percent (19 schools) reported using at least 1 relational, micro based product. Access to mainframe DBMS's only occurred within a database course and was only possible at 7 schools.

Projects

Fourteen schools reported some form of project use in the Introductory MIS course. Projects were usually canned rather than real and done by individuals rather than groups (see Table 10). For the database course, projects were used by all schools responding to the project related questions. Real projects were used more frequently than canned projects. The use of group projects was more prominent than that of individual projects.

Table 7: Level of Database Experience Needed by Business

Level of Experience		% Selecting* (N=23)
Actual working experience in addition to class		69
Years Working Experience Needed	% Selecting (N=16)	
< 1	56	
1-3	31	
> 3	13	
Class with live project		57
Class with canned project		43
Class with application exercises, possible lab		39
Class with minimal textbook exercises		9

Table 8: Database Topic Coverage by Course

Topic	Coverage in Introduction to MIS Course (N=22) %	Coverage in Database Course (N=21) %
Introductory Concepts	100.0	95.2
Logical DB Design	36.4	100.0
Physical DB Design	22.7	85.7
Data Modeling	18.2	100.0
Normalization	9.1	100.0
Relational DB Systems	40.9	95.2
CODASYL DB Systems	13.6	85.7
Hierarchical DB Systems	22.7	90.5
Database Administration	59.1	100.0
Expected DBMS Functions (e.g., recovery)	22.7	95.2
4th Generation Environment	40.9	81.0
Distributed Database	18.2	90.5

DISCUSSION

The findings of this study confirm, as expected, that those schools having database courses are more likely to provide the topic coverage that businesses perceive as needed by end user liaisons than those schools who do not have a database course. The survey results indicated that businesses consider the needed database expertise to be more extensive than a knowledge of just introductory database concepts. According to the businesses surveyed, DB design and relational systems are important topics for end user liaisons to know. Hierarchical and CODASYL systems were not considered very important by this group of respondents.

Normalization was not rated as high as might be expected, considering the high importance rating given to database design. The findings indicated that significantly greater importance was attached to teaching some form of both logical and physical design than to teaching specific techniques like data modeling and normalization that facilitate either type of design. Further investigation is needed to discover what topics businesses consider part of design and what the perceived role of data modeling and normalization are.

For universities that cover database in only a portion of other classes, coverage of topics was limited. In addition, the low percentage of course time devoted to database topics is indicative of a superficial exposure. Based on businesses' perceived needs, the expertise acquired in such a setting would likely be insufficient for an end user liaison job. The Introduction to MIS course simply does not spend enough time on database nor cover sufficient topics. However, the topics perceived as important by businesses do seem to be covered in a database course. Further study is needed to determine if the amount and type of coverage of certain topics in a database course is adequate for business needs or if it provides the necessary concepts and fundamental understanding needed by end user liaisons.

The extensive use of relational systems as well as the number of schools covering the topic of relational database systems indicates that students are obtaining pertinent training with regards to businesses' perceived needs for relational expertise. Another topic which had a high importance rating from businesses, database design, is not as well covered by university courses. In order to meet businesses' perceived needs in this area, the inclusion of database design topics probably needs to be increased.

According to the results of the business questionnaires, knowledge of mainframe and micro DBMS's is important; mini DBMS's not important. On the 5 point scale used to rate importance, there was about a 1 point difference in the rating given mainframe over micro. The importance given to mainframe DBMS's is of significance because of the small number of universities providing experience on mainframes. Actual experience with database products was effectively limited to relational micro based products. Only 32 percent (7 of 21 schools reporting) provided any mainframe experience. However, by providing micros and micro based DBMS's for use, universities do appear to be providing the education about micros deemed important by businesses.

With regard to the necessary level of prior experience needed by a front end liaison, businesses' responses indicated that while limited experience may be acceptable, the more experience the person has the better. Universities may need to attempt to provide more practical

Table 9: University DBMS Environment by Course

Environment	Environment for Introduction to MIS Course (N=19) %	Environment for Database Course (N=22) %
Hardware:		
Mainframe	0	32
Minicomputer	0	0
Microcomputer	100	86
Software:		
Micro		
Relational	100	86
Mainframe		
CODASYL	0	18
Relational	0	23

Table 10: University Project Use by Course

Project Use	Use in Introduction to MIS Course (N=14) %	Use in Database Course (N=24) %
Project Type:		
Canned Projects	57	33
Real Projects	36	46
Both Canned and Real	7	21
Project Work Group:		
Individual Projects	57	25
Group Projects	36	62
Combination Group & Individual	7	12

experience in order to adequately meet this need. For those schools not using projects, they could consider incorporating canned projects. Or if schools already use canned projects, they could consider the feasibility of actual real world projects. In particular, it seems to be important for a database course to provide practical experience in order to fulfill this need for experience. An example of providing practical experience is given by Beccue and Chrisman [2] in a report on the use of live projects to teach database concepts in a senior level database course.

An area for future investigation involves comparing the perceived knowledge needs of end user liaisons to that of other IS staff personnel. Are there different database needs for the different groups of staff? If so, what are they? Are they a difference in content or a difference in depth or level of coverage? The answers to questions such as these have significant implications for universities that are trying to develop curriculum and course content to serve various communities.

SUMMARY

In summary, what should universities be teaching about database to better prepare students to work as end user liaisons? According to businesses, universities should be teaching introductory database concepts, database design, and relational database systems in a hardware environment that includes both mainframe and micro computers. It is important for students to have as much practical experience as possible. Many universities are currently meeting some of these needs by covering introductory concepts and relational systems and by providing experience in a micro DBMS environment. However, most universities are not providing mainframe experience, and topic coverage is too limited unless there is a full course on database.

REFERENCES

[1] Albin, Marvin and Robert W. Otto, "The CIS Curriculum: What Employers Want From CIS and General Business Majors", The Journal of Computer Information Systems, Summer 1987, pp. 15-19.

[2] Beccue, Barbara and Carol Chrisman, "Balancing Practice and Theory in Teaching Database: A Project Approach," Proceedings Fifth Annual Information Systems Education Conference, Atlanta, GA, October 25-26, 1986, pp. 103-105.

[3] Cheney, P.H. and N.R. Lyons, "Information Systems Skill Requirements: A Survey", MIS Quarterly, Vol 4:1, March 1980, pp. 35 - 43.

[4] "DPMA Model Curriculum for Undergraduate Computer Information Systems Education", Data Processing Management Association, Park Ridge, Illinois, 1986.

[5] Jenkins, G.H., "Education Requirements for the Entry Level Business Systems Analyst", Journal of Systems Management, Vol 36:3, August 1986, pp. 30 - 33.

[6] Lindholm, Elizabeth, "The Mandate for Data Base Expertise", Information Center, February 1987, pp. 33-35.

[7] Luce, Thom, "Are MIS/CIS Graduates Getting the Technical Training They Need?", Interface, Vol. 11:3, Fall 1989, pp. 50-55.

[8] Nunamaker, J.F., Couger, J., and Davis, G., "Information Systems Curriculum Recommendations for the 80s: Undergraduate and Graduate Programs", Communications of the ACM, Vol. 25:11, November 1982, pp. 781-805.

[9] SAS/PC, SAS Institute, Box 8000, Cary, North Carolina, 1989.

[10] Watson, Hugh J., Dale Young, Shaila Miranda, Barry Robichaux, and Ron Seerley, "Requisite Skills for New MIS Hires", working paper #32, August 1988, University of Georgia, College of Business Administration.

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