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Thirteenth Annual UCLA Survey of Business School Computer Usage: Where Are Business Schools In The Process of Computerization?

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THE JOHN E. ANDERSON GRADUATE  
SCHOOL OF MANAGEMENT AT UCLA

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IN THE PROCESS OF COMPUTERIZATION?**

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## Executive Summary

*Where* are business schools in the computerization process? This question was the focus of this year's Thirteenth Annual UCLA Survey of Business School Computer Usage. To answer "where?" the same phase diagram was employed as in the Fifth (1988) and Ninth (1992) Surveys, in addition to more traditional checklist questions. The graph incorporates developmental phases, sub-divided into steps ranging from investigation to growth to maturity to phase out. Based on the responding business schools' perceptions, both a snap shot view of *where* schools are this year as well as a longitudinal view for the 108 schools which participated in both the Ninth and Thirteenth Surveys, could be developed. Furthermore, in addition to the broad views based on the full sample of business schools, a more detailed understanding of *where* in the process was gleaned from a cluster analysis which identified five subgroups based on their stage of computerization and their respective issues.

Two hundred ninety-three schools completed the phase diagrams providing data on 43 aspects of the computerization process. For this sample as a whole, business schools can be characterized as in the moderate growth phase, indicating initial acceptance of computer-related concepts but insufficient resources to meet demand. Collectively, the schools perceive themselves to be earlier in those processes which involve newer technology such as Web development and use of laptop computers than those processes which centered around the mini/mainframes and microcomputers.

The area of most dynamic growth between the Ninth and Thirteenth surveys involved the introduction of Windows-based systems. Four years ago, schools were seen in the Start-up phase (initial installation and testing with several users) while this year they were in the Maturity phase (stable user base with resources usually meeting demands). Other areas of significant growth over the past four years were faculty and student use of e-mail systems, and both implementation and use of local area networks, all of which have moved from growth to maturity phases. Within this same period, support to users from the computing organizations was perceived to have not changed at all, remaining at moderate growth, with barely sufficient resources to meet growing demands and expectations.

When compared longitudinally, the computer operating budget showed a significant reversal on the phase diagram, moving from a moderate level of stability back into the high growth phase. This most likely represents a recognition on the part of the business schools that dynamic change is expected by faculty and students and the recognition that it only takes a year or two for both technology and computer skills to become stale. The movement back along the life cycle curve suggests that computer operating budgets are seen as needing to grow rather than having achieved a stable state. However, for the overall sample over the 13 year history of the survey, the median business school computer operating budget allocation per student has remained about the same, approximately \$100 per student. The variation across schools continues to be significant with the bottom quartile schools allocating approximately \$20 per student in contrast to over \$500 per student at the top quartile of schools (when the schools are ranked by computer operating budget expenditures per student).

The survey gathered information from a strategic, instructional, operational, and network perspective. The strategic level concerned planning, the operating budget, strategic issues, and extensive computer facility renovations. Almost three quarters of the business schools reported spending considerable efforts towards their strategic planning efforts. Funding, curriculum development, technological currency, and faculty incentives remained the most critical issues, with emergent strategic issues being concerned with distance education and Web site development. Fifty-eight percent of the schools were involved in a move or significant facility renovation providing opportunities to incorporate the current technological infrastructure into the core of their building.

The instructional level investigated the use of information technology in the pedagogical process. The curriculum-related phase diagrams indicated continuing expectations of higher growth in the use of computers in business schools classrooms and for the impact of that

integration. Actual usage of computers in the classroom was perceived to be in the moderate growth phase. Faculty and student productivity utilizing word processing and simple spreadsheets applications were further along the growth curve with averages near the mature phase, followed by on-line library database access a little lower along the growth curve. The instructional issues identified as critical remained focused on an appropriate level of curriculum integration and faculty incentives. The phase diagram related to classroom electronic/computer-linked equipment showed schools to be actively addressing this concern. The only major increases in recommended and/or required student microcomputer ownership occurred within the EMBA programs.

Ongoing daily operations are the concerns and responsibilities of the business school computer center directors and their support staff. Additionally, new opportunities and their attendant issues are emerging with every software introduction, upgrade, and/or modification as well as with the dynamic hardware technological advancements. Over 80% of the responding schools reported a great deal of interest in the further development of a distinct computing services organization. Growth in recommended/required student ownership, the significant mean change in Windows implementation, and the implementation of multimedia systems were shown to be some of the developments requiring major efforts on the behalf of the computer center support staff. Faculty training and equipment maintenance, together with hardware and software concerns, were the most critical issues facing the daily operations of the computer center. All of these concerns and responsibilities, opportunities and issues are constrained by the current economic and budget realities.

Local area networks (LAN) and Web site support was the fourth perspective investigated in this year's survey. As indicated above, LAN development and use showed significant growth over the past four years. Furthermore, connectivity was shown to be pervasive, with over 75% of the 286 schools providing data responding that all of their student labs, faculty offices, and administrative offices were networked and 68% of these distinct LANs were bridged together. Collectively, the responding schools indicated that they were in the slow growth phase with faculty and students just being introduced to the World Wide Web. The development of a business school's own Web site infrastructure lagged behind this use, with expectations of growth in this area. Information access was the primary purpose identified by the schools for Web site development, although student recruitment and competitive pressures were other reasons given for the schools' interests in developing Web sites.

The increase in power and capability of desktop computers continues to create considerable difficulty in establishing hardware category demarcations. Mini/mainframes were considered to be centrally-controlled time-sharing systems which accommodate multiple concurrent users. In contrast, microcomputers were considered as primarily single user desktop systems and laptops as the portable systems. As network technology matures and all systems become or have the option to become nodes on a network, even these distinctions will become less obvious. Accordingly, instead of completely abandoning their use of mini/mainframes, most of the schools are showing stability or phasing out of the traditional three uses (instruction, research, and administrative) while introducing two new uses, communications and client server technology.

A cluster analysis procedure was employed to clarify the relationship between the issues schools face with the computerization effort and where they are in the process. The same cluster analysis procedure (SAS FASTCLUST) was used with the Fifth and Ninth Surveys, and as before, five distinct clusters emerged from the data provided by the schools. However, in contrast to the earlier surveys, only four of the clusters were the same, and a different fifth cluster of schools emerged. Specifically, clusters identified as Start-up, Mixed, Late Growth, and Stable, had means the same as or very close to those found in both the Fifth and the Ninth Surveys. No cluster showed a mean close to the previous Early Growth mean. Rather, the fifth cluster appeared beyond that of the previous Stable cluster mean and formed a new cluster category, Mature. This cluster seems to reflect the natural progression along the phase diagram, and though totally unexpected, is quite logical.

When considering the various issues, whether strategic, instructional, operational, or network, some were seen to be more independent of where the business schools were in the computerization process. For example, the strategic issues of funding, curriculum development, technological currency, distance education, and faculty incentives were common across all five clusters. On the other hand, the strategic issues of lack of goals and concern with organizational structure were identified by the earlier clusters. Web site development and administrative systems developments were identified by the later clusters. The operational issue of student training was identified by the earlier clusters whereas insufficient hardware, staff currency, and Web standards were identified by the later clusters. Concerns for computer staff burnout was unique to the Mature cluster. The network issues of software and licensing were identified by the earlier clusters in contrast to laptop connectivity being identified by the later clusters. Access security and expansion were unique to the Mature cluster. The instructional issue of inability to use computers in the classroom was identified by the earlier clusters and the problem of courseware development was identified by the later clusters.

Finally, some issues seem to have been resolved during the past eight years. The strategic issues of lack of short term plans and school-wide hardware and software standards, the operational issues of illegal copying of software, insufficient software, and the role of the mini/mainframes, the network issues of data security, incompatibility of competing network technologies, and basic microcomputer connectivity, and the instructional issue of courseware design, were all issues seen as critical in the Fifth but shown to have become less critical in the Ninth. Issues that have become less critical during the four years since the Ninth include the strategic issue of concern (hope) for hardware and software donations, and the operational issues of student training, equipment obsolescence, software licenses, Windows implementation, and graphics, and the network issues of micro to mainframe connectivity and WAN access. The instructional issues remain exactly the same as they were four years ago, indicating that these are primarily issues that cannot be solved by technological advances, learning curves, or even time in the computerization process.

## Open Issues

In preparing this survey report we were struck by the fact that the business schools appear to be getting all the "easy" things done. When looking at the longitudinal data, the greatest growth were the changes in infrastructure (Windows operating system and LAN development). When completing the phase diagrams in 1988, technological issues around LANs and obtaining the "right" equipment were primary. However, over the intervening eight years, many of these issues have been resolved. With the growth of open standards, graphical user interfaces, and "plug-and-play" capability, the struggles over which systems to obtain, which protocol to use, and whether software standards should be imposed, have all worked their way towards resolution with relatively little difficulty. In a sense, this growth is a function of funds available to support the equipment and the computer operational staff.

So what's next? Is there a major challenge facing business schools, even those adequately funded, after the technology infrastructure is in place? The answer from our perspective is a resounding "yes." There is an even more daunting challenge than merely the implementation of the technology, namely, the subsequent organizational and individual behavioral changes.

We may derive some insights from an analogy of incorporating the automobile into the very fabric of our lives. We can think of this having occurred in three stages: an introductory stage followed by an infrastructure development stage which leads to a social transformation stage.

During the introductory stage, people substituted riding in cars rather than on horses or in horse-drawn carriages. People did the same things, but were now able to travel further and faster. As people wanted to and/or began to travel more, a critical mass of automobiles evolved and thus a corresponding new support infrastructure of roads, gas stations, service centers, and used car dealers emerged. Third, a social transformation occurred as new "transportation-

intensive" social and economic structures emerged, with such changes as seen in dating, courting, and family behaviors, and the decline of the inner cities due to the feasibility of suburb life replete with their shopping centers and strip malls.

There are parallels for digital industries and our business schools. The introductory stage for computers was during the 1960s when the systems were used primarily to automate tasks, specifically bookkeeping and accounting functions. The initial systems were just replacements for backroom daily transactions previously done by hand. The microcomputers which began being introduced in earnest in the 1980s were essentially a substitute for typewriters and calculators. The first real "killer app" was the spreadsheet capability of VisiCalc, which encouraged the wide spread use of microcomputers throughout the business world. With this growth, the critical mass necessary to create the focus on infrastructure evolved. As a nation, the "information highway" is being created. Early entries such as America-On-Line and CompuServe are being challenged by the plethora of smaller Internet service providers, and most recently with the entry of the major telecom and cable companies. We don't yet know what new social forms will emerge with interactive home shopping, entertainment, distance education, and telecommuting.

In our business schools, the decade of the 1980's could be represented as the introduction and development of a critical mass of computer literate users. The current decade is focusing on the connectivity infrastructure of LANs, the Internet, the World Wide Web, and e-mail as common forms of communication. And, if the analogy holds, the next decade should be one of social and behavioral change.

The point of this analogy is that the digital world is around us, that our students who will spend most of their working lives in the 21st century, will need to see the computer and related technologies as an extension of themselves, as a tool as important as paper and pencils, abaci, slide rules, and calculators were during the past several hundred years. The promise or vision for information technology is that it will provide the opportunity to enhance our ability to synthesize ideas, gain greater insights into concepts, and be more effective and efficient problem solvers. Clearly, this is a goal which far exceeds using these applications as a basic personal productivity tools. A major challenge facing us as educators will be to fulfill this vision.

## Table of Contents

1	Introduction .....	1
2	Profile of participating schools.....	5
3	The strategic level.....	7
3.1	Strategic planning process .....	7
3.2	Computer operating budgets .....	7
3.3	Strategic computing issues .....	9
3.4	New buildings and/or renovation.....	10
4	Instruction and curriculum.....	10
4.1	Curriculum integration into the business school curriculum .....	10
4.2	Curriculum and integration issues .....	11
5	Hardware .....	12
5.1	Mini/mainframe computers .....	12
5.2	Business school ownership of microcomputers and laptops .....	13
5.3	Student ownership.....	16
5.4	Microcomputer usage .....	16
6	The operational level .....	18
6.1	Computer center .....	18
6.2	User support .....	18
6.3	New technology .....	19
6.4	Computer center operational issues .....	19
7	Communication and networks.....	20
7.1	Development and use of local area networks .....	20
7.2	Communication and network issues .....	22
7.3	Web development and usage.....	23
8	Cluster analysis.....	26
8.1	Cluster demographics .....	26
8.2	Cluster phase means .....	27
8.3	Issues by clusters .....	30

## Appendices

1	Business School Computerization Life Cycle and Phase Definitions.....	32
2	Phase Diagram Question Definitions and Usage Across Surveys.....	33

## List of Figures

1	Phases of Business School Computerization.....	2
2	Phases of Business School Computerization (Longitudinal: 1988-1992-1996) .....	3
3	Phases of Strategic Planning for Computers, Communications, and Information .....	7
4	Median Computer Operating Budget Expenditure by Quartiles .....	8
5	Phases of Computer Operating Budget .....	8
6	Phases of Computer Operating Budget (Longitudinal: 1988-1992-1966).....	9
7	Phases of Computer Integration into the Business School Curriculum .....	10
8	Phases of Computer Integration Impact on the Curriculum .....	10
9	Phases of Electronic/Computer-linked Equipment in the Classroom.....	11
10	Phases of Actual Computer Usage in the Classroom .....	12
11	Phases of Business School Mini/Mainframe Use.....	12



12	Phases of Mini/Mainframe Use as a Communications Server.....	13
13	Phases of Mini/Mainframe Use as Client/Server Technology .....	13
14	Average Number of Desktops and Laptops - An Historical Perspective .....	14
15	Phases of Number of Microcomputers and Labs.....	15
16	Phases of Number of Portable Microcomputers .....	15
17	Phases of Number of Portable Microcomputers (Longitudinal: 1992-1996) .....	15
18	Phases of Number of Sub-notebook Microcomputers .....	16
19	Student Microcomputer Ownership.....	16
20	Phases of Microcomputers Usage as a Productivity Tool .....	16
21	Phases of Microcomputers Usage as an Analytic Tool .....	17
22	Phases of Microcomputers Usage for Desktop Publishing .....	17
23	Phases of CD-ROM Usage.....	17
24	Phases of Microcomputers Usage for On-line Database Access .....	17
25	Phases of Computer Literacy .....	18
26	Phases of Development of Computer Center as a Distinct Organization .....	18
27	Phases of Computer Support to Users.....	18
28	Phases of Windows Implementation .....	19
29	Phases of Windows Implementation (Longitudinal: 1992-1996).....	19
30	Phases of Multimedia Systems Implementation.....	19
31	Phases of Local Area Network Development .....	20
32	Phases of Local Area Network Development (Longitudinal: 1988-1992-1996).....	21
33	Phases of Actual LAN Usage.....	21
34	Phases of Actual LAN Usage (Longitudinal: 1992-1996).....	21
35	Phases of E-Mail Usage.....	22
36	Phases of Faculty E-Mail Usage (Longitudinal: 1992-1996) .....	22
36	Phases of Student E-Mail Usage (Longitudinal: 1992-1996).....	22
38	Phases of Actual Usage of the Internet/Web .....	23
39	Phases of Web Infrastructure Development .....	24
40	Phases of Web Site Content Development.....	24
41	Mean Phases by Cluster.....	28

### List of Tables

1	Mean Changes for 24 Phases (Longitudinal: 1992-1996) .....	4
2	Demographics of Participating Schools .....	6
3	Demographics of Longitudinal Schools (1988-1992-1996).....	7
4	Business School Strategic Computing Issues .....	9
5	Business School Curriculum and Instructional Issues .....	11
6	Business School Mini/Mainframe Systems Usage Patterns.....	12
7	Business School Microcomputer Ownership .....	13
8	Microcomputer Sufficiency by User Group .....	14
9	Business School Computer Center Operational Issues .....	20
10	User Access to LANs.....	22
11	Communication and Network Issues .....	23
12	Web Site Development and Maintenance .....	24
13	Web Site Content Availability .....	25
14	Web Site Media .....	25
15	Web-related Services .....	25
16	Comparison of Clusters (1988-1992-1996).....	26
17	Demographics by Cluster.....	27
18	Issues by Cluster .....	29

## 1. Introduction

*Where* are business schools with respect to their use of computers, information technology, and electronic communication? Business schools and their users have an extensive variety of hardware, software, and network options. Faculty, student, and administrative requirements and expectations continue to change as they experience and become aware of emergent technologies. Further, the dynamic changes of these options exacerbate planning and resource allocations. Business school policy and decision makers continue to need information which enables them to achieve a perspective beyond the boundary of their own school.

The goal of this, the Thirteenth UCLA Survey of Business School Computer Usage, conducted in cooperation with the American Assembly of Collegiate Schools of Business (AACSB), is to continue to monitor, report, and reflect on the changing nature of the business school computing environment. The purpose over the past 13 years has remained the same: to provide information that can assist with business school program plans and computer allocation decisions. As always, it is stressed that the focus of these surveys is to summarize what the schools report they are doing rather than project what they should be doing.

For the first nine years, the Annual UCLA Surveys reported on data from AACSB accredited business schools in the United States and major Canadian schools. In 1993, because of growing international interest in the North American data and requests for a more global perspective, the population was expanded in spite of confounding issues such as differences in culture and economics, educational structures and traditions, language barriers, funding sources, and governmental policies. In 1994, the population was further expanded to include the entire AACSB membership which includes accredited as well as non-accredited schools. This 1996 survey continues with this inclusive population.

The First, Second, Fourth, Sixth, Eighth and Tenth Surveys presented information on the hardware, software, and other computer resources of the schools. The focus of the surveys between these "what resources?" report changes, provide information on more distinct issues. Thus, the Third Survey polled the deans as to their concerns related to business school computer issues. The Fifth and Ninth Surveys focused on business school computerization in terms of process, pointing out that the introduction, diffusion, and use of technology is ongoing and that the schools may not only be approaching computerization differently, but also at different implementation rates. The Seventh and Twelfth Surveys detailed computer operating budgets and services to provide an overview of budget distributions and estimated service costs. The Eleventh Survey focused on new technologies.

This year's survey, the Thirteenth, like the Fifth and the Ninth, considers business school computerization in terms of process. The seven page questionnaire requested four types of data: demographics, short description, ranking, and phase. Four issue categories (strategic, instructional, operational, and communications and network) were presented for ranking. Although these issue categories were the same as previously used in the Fifth and Ninth Surveys, the issue details continued to be modified to reflect the inclusion of new concerns.

The phase data focused on the process of business school computerization and utilized a "phase diagram" question format developed by the authors based on life cycle process type graphs and personal experience. Appendix 1 gives the phase definition response instructions and defines each phase as given in the questionnaire. Eleven possible responses are delineated by points along a diagrammed process continuum. In these phase questions, the respondents identified their perception of *where* their particular school was, the "phase", for forty-three different items related to business school computerization. Thus, the phase responses are related to the individual business school respondent's concept of a stable or mature environment and

<sup>1</sup> Copies of past *Annual UCLA Surveys of Business School Computer Usage* can be obtained for US\$30 each from Computing Services, Anderson School at UCLA, Los Angeles, CA 90095-1481; fax 310-825-4835. Additional copies of the *Thirteenth Survey* are US\$50 each.

<sup>2</sup> Interested researchers can access the datasets set via anonymous FTP from [anderson.ucla.edu](http://anderson.ucla.edu/pub/surveys/survey1996) in the directory `/pub/surveys/survey1996`.

are dependent on the perception of the specific individual completing the questionnaire. Furthermore, the responses do not start at a common point (e.g. no computers) or a specific point in time (e.g. 1980). Thus, the phase diagram responses represent a subjective reflection of where the particular respondent views his/her business school along a computerization process continuum. It indicates, to some extent, past accomplishments, present conditions, and future expectations.

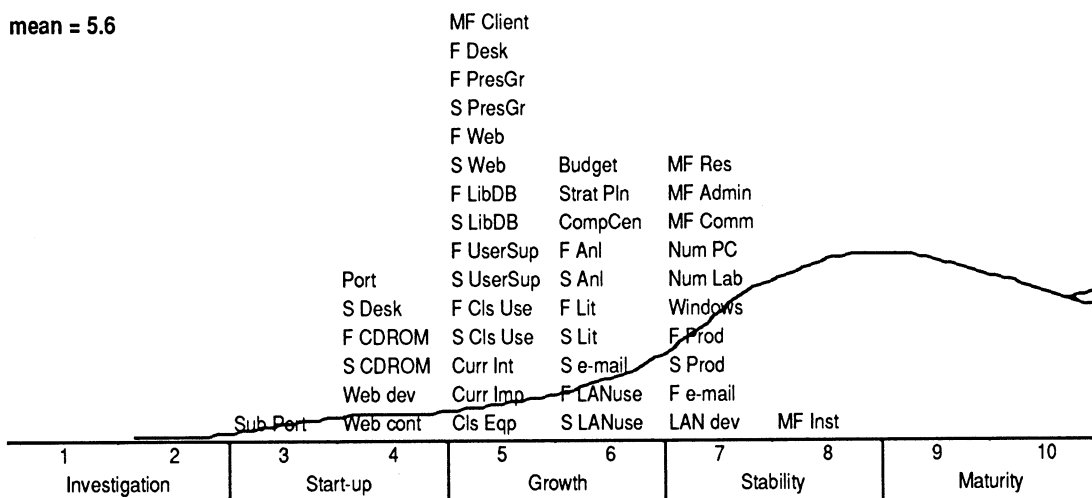
Sixteen of this year's phase diagram questions were replications of those presented in the Fifth and the Ninth Surveys. Eight other questions were replications of those presented in the Ninth Survey. These questions allow longitudinal comparisons. The nineteen phase diagrams new in the Thirteenth Survey questionnaire further delineate previous phase questions and/or concentrate on the changes occurring in communication-related technology.

**Where are business schools with respect to computerization?**

One answer to this question is the average of all of the business schools' responses to all of the 43 phase questions. This single point, 5.6, moderate growth phase, suggests that, overall, the 293 business schools in this year's sample are just beyond slow growth and not quite yet at fast growth. Figure 1 presents this overall summary view, superimposing the separate means for each of the 43 phase questions onto the phase diagram. Appendix 2 gives the abbreviated phase descriptions used in this figure and throughout the report. Further, this appendix shows the replications and changes in the phase diagram questions between the Fifth, Ninth, and Thirteenth Surveys.

Figure 1 shows that collectively the 293 business schools participating in this year's survey are at the start-up phase in sub-notebook and regular portables, student use of microcomputers for desktop publishing, faculty and student use of CD-ROMs, and in the development of their Web infrastructure and content. In contrast, the business schools collectively reflect a mature phase of development with respect to mini/mainframe use in research, administrative support, communication, and instruction, both the number of microcomputers and the number of micro-computer labs, implementation of Windows systems, faculty and student usage of microcomputers as a productivity tool, faculty use of e-mail, and the development of local area networks.

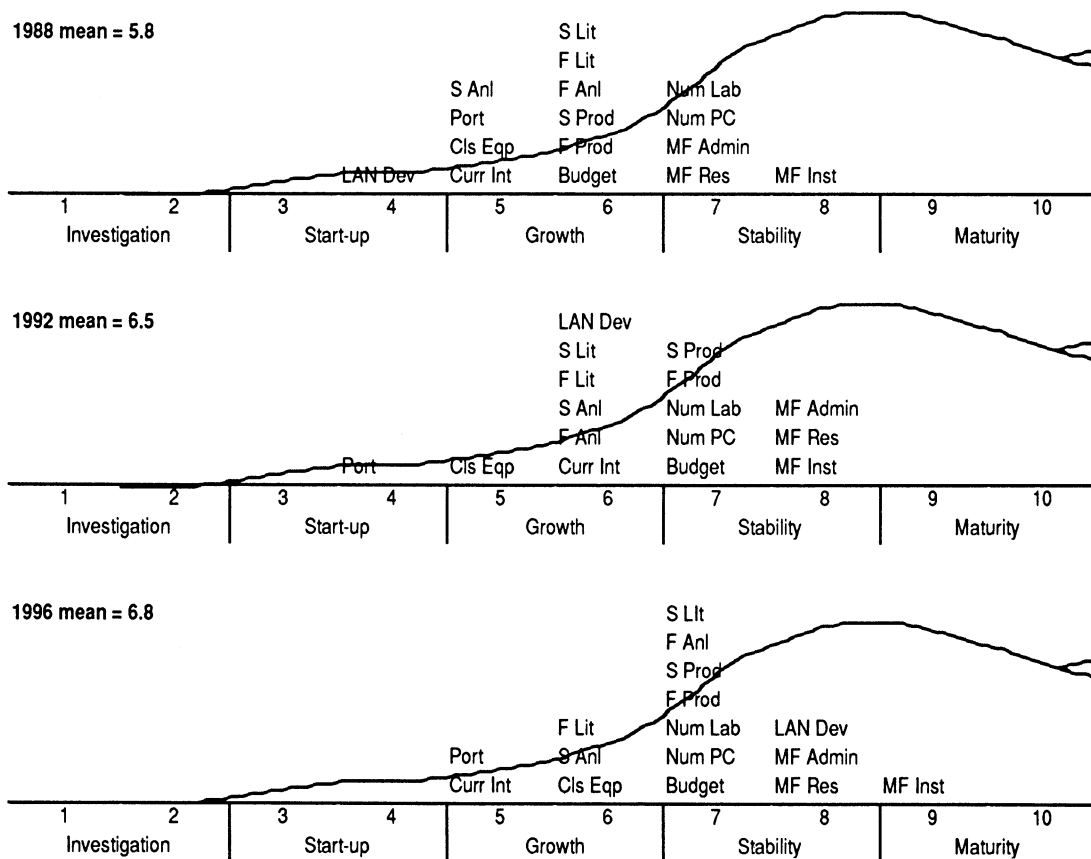
**Figure 1**  
**Phases of Business School Computerization**  
**N = 293**



When this year's aggregate mean of 5.6 is compared to the total sample means of 5.2 and 5.3 for the total samples in the 1988 Fifth Survey and the 1992 Ninth Survey (175 and 178 participating schools respectively), very little growth is suggested. This simple comparison and the immediate intuitive conclusion, however, is not accurate. The surveys comprise differing phase questions and differing sets of business schools. Additionally, many of the phase questions that have been added since the Fifth Survey concerned newly emerging technological issues, such as multimedia systems or Windows implementation for the Ninth Survey and Web site development and usage for the Thirteenth Survey. These technological innovations are too new for many schools to respond very far along the life cycle curve, thus restraining the overall mean scores.

However, longitudinal phase data is available for 79 schools which have participated in the Fifth, Ninth, and Thirteenth Surveys, and for 108 schools participating in the Ninth and Thirteenth Surveys. Demographically, these schools remain similar to the total sample (see Table 3 in Section 2 below). Figure 2 presents the longitudinal phase diagrams for the 79 business schools participating in all three surveys. For the 16 phase questions which are the same across all three of these surveys (detailed in Appendix 2), this single "where" point is 6.8 (approaching stability) for this year's (1995-1996 academic year) survey, changing from 6.5 (high growth), and 5.8 (moderate growth) in the Fifth Survey (academic year 1987-88). Considerable variance in growth is seen between the 16 phase items. As an example LAN development was reported to be in the Start-up phase in the 1988 data, moved into Late Growth in the 1992 data, and is now in the Stability phase. In contrast, both curriculum integration and electronic/computer-linked equipment in the business school classrooms computers have stayed in the Growth phase across the three surveys.

**Figure 2**  
**Phases of Business School Computerization**  
**(Longitudinal: 1988-1992-1996)**  
**N = 79**



Mini/mainframe use has shown a steady and consistent move through the Stability phase, with the use of the mini/mainframe in business school instruction entering the maturity phase in this year's data. Student and faculty use of microcomputers as a productivity tool, the number of the both business school owned microcomputers and the number of computer labs, as well as the computer operating budget, have remained in the Stable phase for the last two survey periods. In general, and as may be expected, the areas of computerization lower on the diagram generally showed greater movement than those at or near the mature phases.

As another perspective of the change in business school computerization, the 24 phase questions replicated between the 1992 and the 1996 surveys are ranked in Table 1 by mean change growth difference for the 108 business schools participating in both of these surveys. T-tests showed the mean changes significant at the 0.001 level for five areas and at the 0.01 level for two more. Six areas showed significant increases in mean phase growth, led by Windows implementation which grew by almost four phases. Student e-mail use grew just over two and a half phases, while faculty use of e-mail and local area network development each grew about two. Both LAN use and use of laptop and portable systems increased only about one phase. One area, computer operating budgets, showed significant negative phase movement, decreasing almost one full phase. The remaining 17 areas changed less than one phase and where not statistically significant.

**Table 1**  
**Mean Changes for 24 Phases**  
**(Longitudinal: 1992-1996)**  
**N = 108**

	N	1992	1996	Mean change	t	sig
Windows	103	3.4	7.2	3.9	15.56	0.000 **
S e-mail	97	4.0	6.6	2.6	10.97	0.000 **
F e-mail	106	5.0	6.9	1.9	0.94	0.000 **
LAN Dev	106	5.7	7.4	1.7	7.52	0.000 **
LAN Use	100	5.4	6.7	1.3	5.64	0.000 **
Port	97	4.1	5.0	0.9	3.06	0.003 *
MF Comm	49	7.2	8.0	0.8	1.61	0.114
Strat Plan	93	5.5	6.2	0.8	2.48	0.015
MF Inst	56	8.1	8.7	0.6	1.28	0.204
Cls Eqp	107	4.8	5.4	0.6	2.56	0.012
S Lit	108	6.0	6.4	0.4	2.10	0.038
S Prod	107	6.7	6.9	0.3	1.94	0.055
F Prod	108	6.8	7.0	0.2	1.34	0.183
S Anl	108	5.6	6.1	0.2	1.17	0.243
F Anl	108	6.2	6.4	0.2	1.10	0.273
MF Res	58	7.7	7.8	0.2	0.40	0.688
F Lit	108	6.1	6.3	0.1	0.66	0.509
User Sup	104	5.6	5.7	0.1	0.36	0.718
Num PC	108	7.3	7.4	0.0	0.22	0.823
Num Lab	103	7.3	7.3	0.0	0.09	0.926
MF Admin	48	7.7	7.7	0.0	0.05	0.962
Curr Int	105	5.7	5.4	-0.3	-1.55	0.124
Curr Imp	105	5.5	5.0	-0.4	-1.93	0.056
Budget	62	7.3	6.5	-0.8	-3.05	0.003 *
<b>Mean</b>		<b>6.0</b>	<b>6.7</b>	<b>0.7</b>		

\*\* significant at 0.001

\* significant at 0.01

With regard to Table 1, the amount of change to be expected must be considered relative to the phase context in which it occurs. Conceptually, less change can be expected at stability, phase 7 and phase 8, than at the slow growth, phase 5, or fast growth, phase 6.

After a brief presentation of the sample demographics, the schools (public and private, large and small, early and late adopters) are combined to look at the data for each of the computerization process areas. Comparative longitudinal phase diagrams for the 108 schools participating in both the Ninth and Thirteenth Surveys will be presented for five areas for which the 1992-1996 change was significant at the 0.001 or 0.01 levels as given in Table 1. Longitudinal data for 79 business schools will be given for two areas, the computer operating budget and development of local area networks, phase areas which have been significant between all three surveys.

Additionally, throughout this report, where appropriate and available, data from the previous surveys may also be included. However, in contrast to the direct comparisons for the 108 business schools participating in both the Ninth and Thirteenth Surveys or the 79 business schools participating in the Fifth, Ninth, and Thirteenth Surveys, the data from the other surveys do not reflect an exact longitudinal study, as the same schools are not followed over a period of time. The accuracy of comparisons over the years is a function of the composition of the changing sample. However, given the overall consistency of the sample and its demographic structure as described in the next section, the identification of some general trends is appropriate.

The final section of this report identifies five clusters of the 293 schools in this year's survey based on their similarity of responses to the 43 phase questions. Issues differences between each cluster of business schools are discussed.

This report is divided into eight sections: introduction, profile of the participating schools, the strategic level, instruction and curriculum, hardware, the operational level, communication and networks, and cluster analysis. Two appendices detail the business school computerization life cycle phase definitions and the abbreviations used throughout this report.

## **2. Profile of the participating schools**

This year's questionnaire was sent to the entire membership (771 schools) of the AACSB, including 125 schools from 33 countries other than the United States. Two hundred ninety-three business schools choose to participate, a 38% response rate. The questionnaires were completed primarily by deans and associate/assistant deans (44%), computer center directors (23%), and faculty members (15%).

Table 2 displays general demographic information about the 293 schools in this year's sample, together with demographics from most of the previous surveys. In general, the table reflects a consistent demographic profile with the sample remaining predominantly North American. However, slight differences, should be considered. This year's sample shows the lowest percentage of publicly-funded business schools and the offsetting largest percentage of private schools, 60% and 36% respectively. The percentages of degrees offered remains about the same after the major change in population beginning with the Eleventh Survey. Changes in the student enrollment (FTE) data show the greatest difference over time. The smaller programs, those with less than 1000 students, now comprise the largest percentage of the sample in contrast to the early samples which showed a more even distribution between all four student FTE categories.

Table 3 presents sample demographics for the longitudinal comparisons. One hundred eight schools (37%) participated in both the Ninth and the Thirteenth Surveys, and 79 (27%) participated in the Fifth, Ninth, and Thirteenth Surveys.



**Table 3**  
**Demographics of Longitudinal Schools (1988-1992-1996)**  
 (percent of schools)

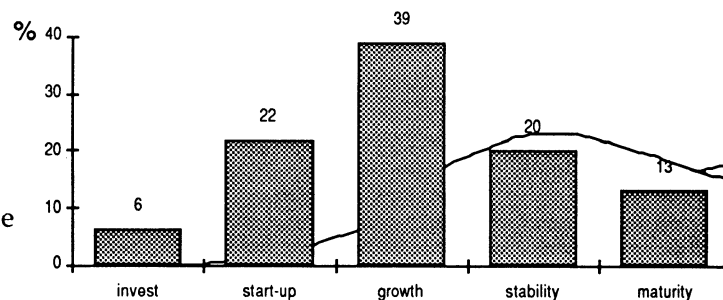
	Fifth 1988 N=175	Ninth 1992 N=178	Thirteenth 1996 N=293	1988-1992-1996 N=79	1992-1996 N=108
Type of school:					
Public	68%	71%	60%	70%	69%
Private	32	29	36	28	29
No data			4	2	2
Degrees offered:					
Undergraduate only	2	6	12	3	5
Undergraduate & graduate	88	86	74	82	80
Graduate only	10	6	7	10	9
No data	-	2	7	5	6
Student enrollment (FTE):					
Less than 1000 students	24	18	37	23	23
Between 1000 and 2000	21	33	30	33	34
Between 2000 and 3000	23	20	14	23	19
More than 3000 students	32	27	11	16	18
No data		2	8	5	6

### 3. The strategic level

#### 3.1 Strategic planning process

Figure 3 diagrams the phases of strategic planning for computers, communications, and information for the 267 business schools providing data. The aggregate mean is 5.7 (moderate growth), indicating that the schools in this sample perceive themselves in the middle of the growth phase with regard to their strategic planning efforts. Almost three quarters of the schools are either in the growth (39%), stability (20%) or maturity phase (13%), attesting to the importance of strategic planning. The longitudinal data, Table 1, emphasizes the amount of change in the strategic planning process. The 93 schools providing strategic planning data for both the Ninth and the Thirteenth Surveys moved almost one complete phase (0.8), with the t-test comparison showing a 0.05 level of significance.

**Figure 3**  
**Phases of Strategic Planning for**  
**Computers, Communications, and Information**  
 N = 267  
 mean = 5.7



#### 3.2 Computer operating budgets

The respondents were asked to provide the total of their business school's computer operating budget, including staff salaries/benefits, software/data acquisition and licenses, supplies, operating overhead, computer recharge funds, and equipment maintenance, and excluding faculty salaries, lease payments, and capital expenditures where the list value was greater than \$2000 and depreciated three or more years. The operating budget estimate mean was \$342,000 (with a range of \$2000 to \$3,700,000) for the 225 business schools providing this data.

To provide a basis of comparison for the budget data across the business schools, the annual computing operating budget was converted into a per student statistic by dividing the reported



operating budget by the reported total student full-time equivalent (FTE). For the 214 schools providing both the computer operating budget and the student enrollment data, the dollar per student values were ranked and separated into quartiles. Figure 4 presents the median computer operating dollar per student FTE over an eleven year period using median quartile data. This view shows a reasonably stable pattern of differences in computer dollars spent by the quartile schools, with the first quartile schools spending about four times as much per student as the second quartile schools, ten times as much as the third quartile schools, and twenty-five times as much as the fourth quartile schools. These ratios have held quite consistent, not only over time, but also over changes in the samples and populations.

**Figure 4**  
**Median Computer Operating Budget Expenditure by Quartiles**

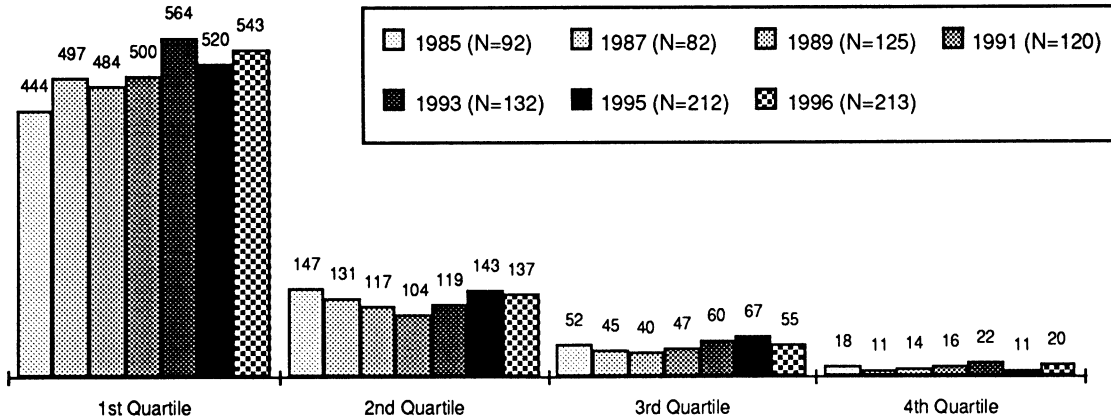
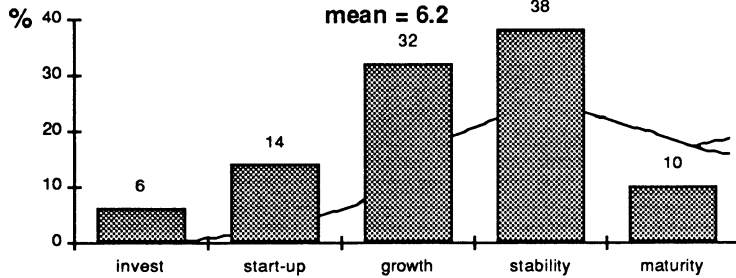


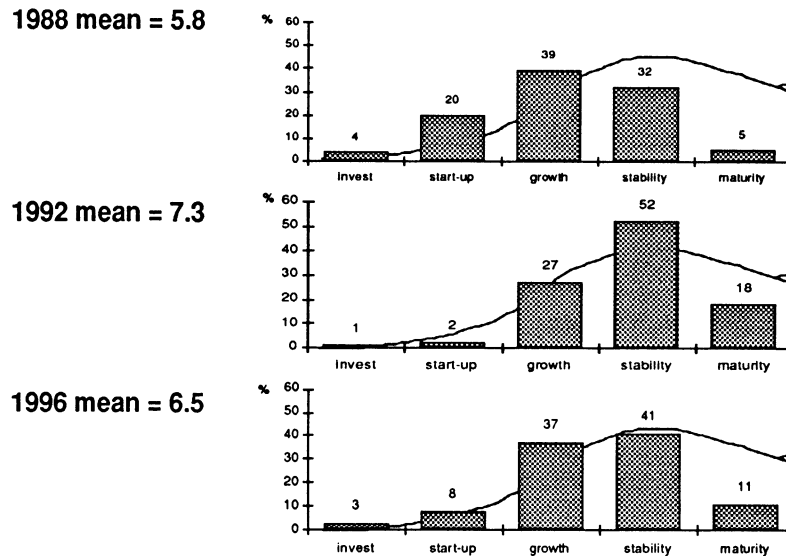
Figure 5 presents the budget phase diagram data for the 266 business schools responding to this question. The mean is 6.2 (high growth) and the phase diagram shows that 52% of the schools consider their computer operating budget to be within the investigation, start-up, or growth phases and 48% considering their computer operating budget to be in the stable or mature phase.

**Figure 5**  
**Phases of Computer Operating Budget**  
N = 266  
mean = 6.2



The t-test showed a significant change in the computer operating budget between the Ninth and the Thirteenth data (Table 1). In the Ninth Survey, this change was also reported as significant between the Fifth and the Ninth data. Figure 6 provides a longitudinal comparison for the 62 business schools reporting budget phase diagram data for all three surveys and shows that their means were 5.8 (moderate growth), 7.3 (stability), and 6.5 (high growth), respectively for the Fifth, Ninth, and Thirteenth Surveys. Over the past eight years (1988 to 1996), these 62 schools first showed a significant positive progression along the phase diagram and then reversed to show a significant negative progression. This can be interpreted as reflecting the schools' perception of more growth being required and available for their computer operating budget.

**Figure 6**  
**Phases of Computer Operating Budget (Longitudinal: 1988-1992-1996)**  
**N = 62**



### 3.3 Strategic computing issues

The survey questionnaire presented a list of 20 strategic computing issues from which the respondents were asked to rank the six most important. Table 4 ranks the issues identified by at least one-third of the schools, and compares these issue rankings with those of the Ninth and Fifth Surveys. Four strategic issues have consistently remained as most critical across all three surveys — adequate funding for operational support, appropriate curriculum development utilizing computing, technological currency, and faculty incentives. The emergent issues in this year's survey are those of distance education/learning/teleconferencing and Web site development and are the focus of a new set of questions in this year's survey discussed more extensively near the end of this report. Several schools indicated "other" issues, not given on the list. However, all of these issues were operationally-oriented and will be addressed later.

**Table 4**  
**Business School Strategic Computing Issues**

Issue	1996 N = 282		1992 N = 165		1988 N = 175	
	Rank	%	Rank	%	Rank	%
Adequate funding for operational support	1	67	1	84	1	74
Appropriate curriculum development utilizing computing	1	67	2	72	2	71
Keeping current on what technology is appropriate	3	53	3	54	3	59
Distance education/learning/teleconferencing	4	45				
Web site development	5	42				
Faculty incentives for courseware development/integration	5	42	3	54	4	49
Obtaining hardware/software donations			5	53		
Managing user expectations	7	37	6	47		

### 3.4 New buildings and/or renovation

Almost all of the schools (98%) provided information regarding their status on a new business school building or extensive computer facility renovations. Forty-two percent of these schools indicated that they were not involved with either, almost the same percentage as in the Ninth Survey. Eighteen percent of the schools reported that they had either moved last year or between two to five years ago. Of the remaining, 11% of the schools indicated they were in the initial planning stages, 15% were in the process of an immediate move or renovation, either moving now or next year. Fourteen percent have a move or extensive renovation planned within two to five years.

Overall, the responses of the majority, 58% of business schools who answered this question, point toward a major change with the potential to significantly upgrade the infrastructure to better accommodate the integration of technology.

## 4.0 Instruction and curriculum

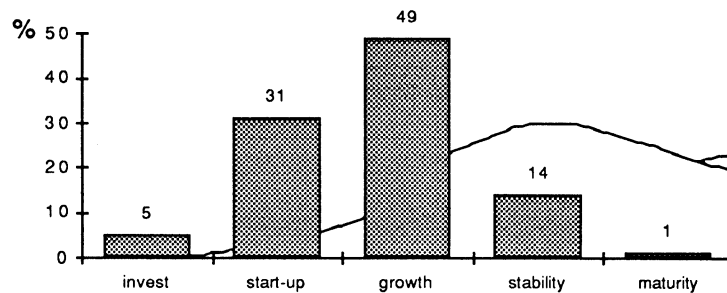
### 4.1 Curriculum integration into the business school curriculum

Where are business schools in their use of computers in instruction? With an average phase mean of 5.1 (moderate growth) for the 286 schools providing data, Figure 7 shows that 49% of the respondents perceive their schools in a growth phase regarding computer integration into the business school curriculum, 31% perceive their schools in the start-up phase, and 14% perceiving their schools in a stability phase.

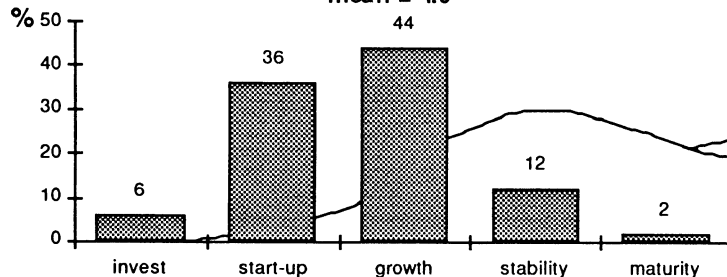
Reference to Table 1 shows that the mean phase change for the longitudinal sample changed from a phase mean of 5.7 (almost high growth) in 1992 to 5.1 (moderate growth) in 1996, a change which represents a slight, nonsignificant, negative change along the growth curve. This overview of the schools' perceptions indicate that all but the 15% of them in the stable or mature phase are continuing to expect more use of computers in their classrooms.

With these continuing expectations, it is reasonable to assume that the schools consider this integration to be having a positive impact. Figure 8 confirms this assumption and shows the schools' perceptions of this impact. The average phase mean is 4.9 (slow growth) for the 283 schools providing data. Two percent of the schools indicated a mature phase of the impact of their curriculum integration. The 12% in the stable phase can be assumed to be reasonably satisfied with their impacts and the remaining 86% are showing expectations of increasing

**Figure 7**  
Phases of Computer Integration  
into the Business School Curriculum  
N = 286  
mean = 5.1



**Figure 8**  
Phases of Computer Integration Impact on the Curriculum  
N = 283  
mean = 4.9



impacts on the curriculum resulting from their implementations of information technology. Reference to Table 1 again shows that the mean phase change for the longitudinal sample, like that of the phase of curriculum integration, represented a slight, nonsignificant, negative change along the growth curve, changing from a phase mean of 5.5 (moderate growth) in 1992 to 5.0 (very moderate growth) in 1996.

#### 4.2 Curriculum and integration issues

In spite of the expectations of greater curriculum integration and impact, many challenges surface as information technology is introduced into the classroom. Table 5 lists the issues identified by at least one-third of the responding schools and compares these issue rankings with those of the Ninth and Fifth Surveys. The issue identified as most critical by 72% of the schools responding in this year's survey was that of defining an appropriate level of curriculum integration, followed closely by the selection of courses to be integrated. Also related to these curriculum issues and ranking third is the issue of faculty incentives for developing courseware. The issues of faculty incentives and teaching style/motivations to use the technology will probably remain among those identified as critical until the traditional criteria for promotion and tenure are revised to acknowledge the time spent on courseware development and computer integration.

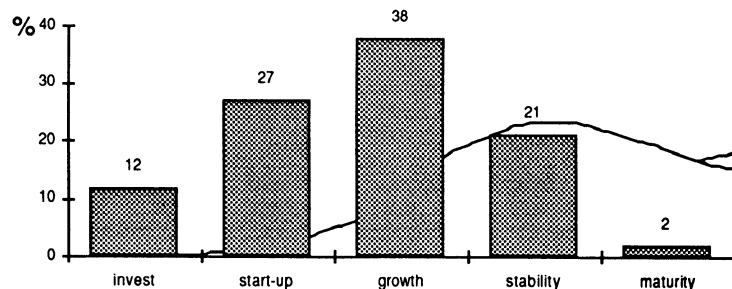
Courseware design ranked among those considered as most critical for the first time this year, whereas the support-related issues which met the criteria of being identified by at least one third of the respondents in the previous surveys dropped out. The increasing addition of computer courseware into standard business textbooks by the major publishers may have lessened the pressure for these support issues. In Table 5, the issue of inability to use computers in the classroom, the basic equipment problem, can be seen as becoming more critical, with this issue now being ranked as 4th, as opposed to being ranked 6th and 7th in the earlier surveys. Pragmatics such as equipment delivery, security, configuration changes to meet individual faculty needs, and guarantees against frustrating malfunctions which often supersede the value of the lesson have not yet been overcome.

**Table 5**  
**Business School Curriculum and Instructional Issues**

Issue	1996 N = 282		1992 N = 165		1988 N = 175	
	Rank	%	Rank	%	Rank	%
Defining an appropriate level of curriculum integration	1	72	3	73	2	67
Selection of courses to be integrated	2	69	5	55	5	51
Faculty incentives for developing courseware	3	56	1	84	1	70
Inability to use computers in classrooms	4	53	6	53	7	40
Lack of courseware	5	51	7	45	7	40
Courseware design	5	51				
Teaching style/motivation to use technology	7	48	2	80	3	64

Figure 9 shows that the business schools are aggressively dealing with the basic equipment issue and the inability to use computers in the classroom. With a mean of 5.0 (moderate growth), this phase diagram shows that 65% of the schools are either in the start-up phase or in the growth phase of dealing with their electronic/computer-linked equipment in their classrooms, with 12% more actively investigating alternatives. Only 23% of the schools report that they perceive their schools as stable or mature with little change expected. Table 1 shows that there was a positive movement of over half a phase (but not quite significant at the 0.01 level) along the growth curve when comparing the 1992 and 1996

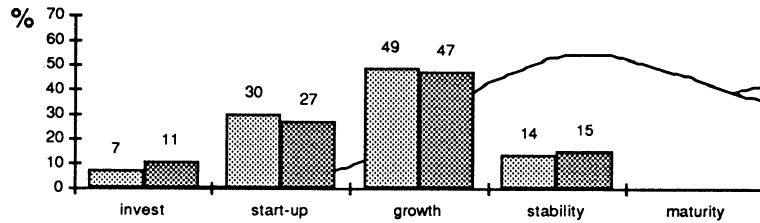
**Figure 9**  
**Phases of Electronic/Computer-linked Equipment in the Classroom**  
N = 287  
mean = 5.0



data for 107 schools. These phase designations suggest that even with the existing problems, the business schools continue to show a clear commitment to the continuing use of information technology, together with expectations of more progress in actual implementation.

A new "where"-oriented phase question was introduced this year to capture the schools' perception of actual faculty and student use of computers in their classrooms. Figure 10 shows this actual usage by faculty and students to be quite similar, with means of 5.0 and 4.9 (entering moderate growth). Approximately 14% of the schools are perceiving their faculty and students to be in the stable phase with little expectation of further growth in their actual use of computers in the classroom, supporting the other phase diagrams in this section.

**Figure 10**  
**Phases of Actual Computer Usage in the Classroom**  
 Faculty N = 290 mean = 5.0    Student N = 280 mean = 4.9



## 5.0 Hardware

### 5.1 Mini/mainframe computers

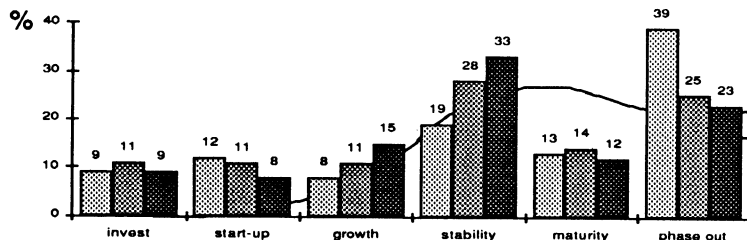
One hundred sixteen (40%) of the business schools participating in this year's survey indicated that their users had access to mini/mainframe systems. Usage patterns, summarized in Table 6, show that almost half of these schools, 48%, used their mini/mainframes for course instruction, research, administrative applications, and for communications. The following 23% of the business schools used their mini/mainframes for differing combinations of three of the four applications. In contrast the next 12% of the schools used their mini/mainframes for a single purpose: five percent for administration only, four percent for research only, and three percent as a communications server only. The remaining 17% are used for some combination of two of the three uses.

**Table 6**  
**Business School Mini/Mainframe Systems Usage Patterns**  
 N = 116  
 (percent of schools)

%	Instruction	Research	Administration	Communication
48	I	R	A	C
10	I	R	A	
7	I	R		C
6		R	A	C
5			A	
4		R		
3				C

Figure 11 shows the use of mini/mainframes as perceived by the schools along the growth curve. Although none of the three traditional primary uses of the mini/mainframe (instruction, research, and administrative) showed significant levels of change in Table 1, instructional and research use progressed positively along the growth curve and administrative use remained the same.

**Figure 11**  
**Phases of Business School Mini/Mainframe Use**  
 Instruction N = 142 mean = 8.0    Research N = 146 mean = 7.4    Administrative N = 129 mean = 7.4



This phase diagram shows that a large percentage of the responding schools are phasing out their use of the mini/mainframes in these areas.

Figure 12 shows 136 business schools' phase diagram responses for use of the mini/mainframe as a communications server. With a mean of 7.0 (early stability), this use is presented as slightly

lower than the traditional uses of the mini/mainframe given in Figure 11. However, the mean in this instance is deceptive, as the diagram is actually bi-modal and showed that 84% of the schools are investing considerable effort into this area, 62% of the schools in the development and growth phases and 22% in the process of re-evaluating their use of these systems.

**Figure 12**  
**Phases of Mini/Mainframe Use as a Communications Server**  
**N = 136**  
**mean = 7.0**

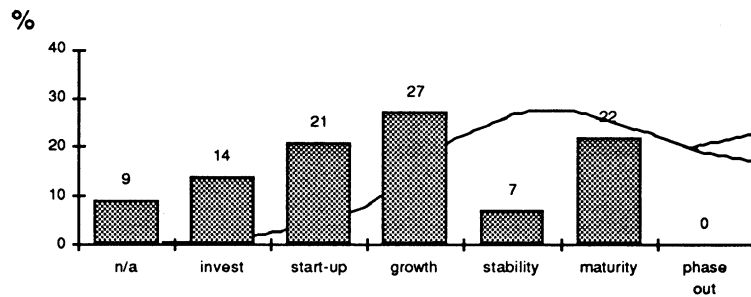
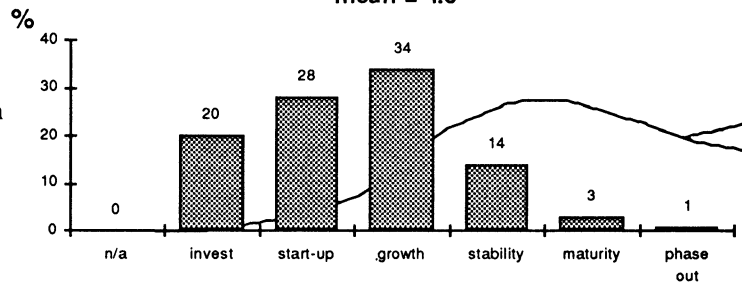


Figure 13 presents another use for the mini/mainframe, that of a client server, primarily providing database access. This newer use and technology is reflected in a mean, 4.5 (just entering the growth phase), which is lower than that of the system's use as a communications server. For the 204 schools responding to this question, only 18% of them perceived themselves at the stable phase or beyond. These last two diagrams, Figures 12 and 13, show that instead of being completely phased-out, other uses beyond the traditional three (instruction, research, and administrative) are being developed for the business schools' mini/mainframes.

**Figure 13**  
**Phases of Mini/Mainframe Use as Client/Server Technology**  
**N = 204**  
**mean = 4.5**



### 5.2 Business school ownership of microcomputers and laptops

The demarcation between hardware categories continues to blur. Thus, this section will discuss microcomputers and laptops simultaneously, rather than separately as in previous reports. Further, the separate section for 32-bit high end processors has been eliminated.

**Table 7**  
**Business School Microcomputer Ownership**  
**N = 289**

	Schools		Systems		Totals
	n	%	n	%	
<b>Desktops</b>					
Apple	174	60	6115	11	
DOS only	128	44	4331	8	
DOS/Windows	286	99	44555	77	
UNIX	107	37	979	2	
Other (NT, OS2, etc)	46	16	1670	3	
Total					57650
Average per school					199.5
<b>Laptops</b>					
Apple Powerbooks	106	37	508	12	
DOS only	75	26	437	10	
DOS/Windows	210	73	3438	78	
Total					4383
Average per school					15.2
<b>Total microcomputers</b>					62033
<b>Average per school</b>					214.6

Table 7 summarizes the microcomputer data as given by 289 (99%) of the schools. The responding schools reported owning 57,650 microcomputers and 4383 laptops, totaling 62,033 systems, an average of 215 systems per school. Essentially all of the schools, 99%, had DOS/Windows desktop microcomputer systems and 60% Apple desktop systems. And, as can be seen in Table 7, DOS/Windows represented 77% of the total number of desktop microcomputers. Considering only the desktop systems, there was an average of 200 systems per business school.

Seventy-three percent of the schools reported owning DOS/Windows laptops and 37% Apple Powerbooks, with the DOS/Windows systems representing 78% of the total number of laptops. Considering only the laptop systems, there was an average of 15 laptops for the 289 business schools. The data showed that the desktop systems are about equally available for students and faculty, 40% and 36% respectively, followed by 22% for staff, and 2% for use as network servers. The laptops are predominantly allocated to the faculty, 52%, and then to students, 33%, and to staff, 16%.

Figure 14 displays a longitudinal view (1985-1996) of business school owned microcomputer and laptop systems. The average number of business school desktop systems can be seen to have peaked in 1993 with an average of 239 business school owned systems, and has slowly but steadily declined since then to an average of 200 in 1996. The number of business school owned laptops peaked earlier, in 1989, at an average of 35 laptops per school, and has slowly declined to the 1996 average of 15 per school. One explanation for these declines is the increase in expectancy of student ownership of their own systems and avoidance of the replication of business school owned resources. Another is the expansion of the sample in 1994.

**Figure 14**  
Average Number of Desktops and Laptops - An Historical Perspective (1985 - 1996)

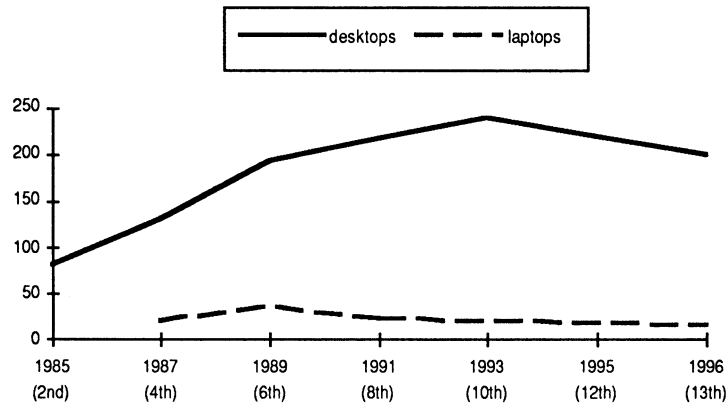


Table 8 which summarizes microcomputer sufficiency shows that the business schools in general consider their present level of microcomputer ownership as sufficient for their various user groups. Thus, there is little expectation of further growth in the number of microcomputers at the business schools. Ninety-five percent of the schools report that with microcomputer densities of 1.3 and 1.5 (just over one faculty member sharing access to a single microcomputer) there is never or just occasional waiting. With higher densities there is usually or always a wait. The data for undergraduate students is not as clear. Although 73% of the schools report that even

**Table 8**  
Microcomputer Sufficiency by User Group (percent of schools)

	Faculty N = 259		Undergraduate N = 232		MBA N = 231	
	%	density	%	density	%	density
yes						
Never any waiting	75	1.30	10	24	14	26
Occasional waiting	20	1.50	63	47	60	37
no						
Usually a wait	5	4.80	24	20	24	47
Always a wait	<1	2.70	3	36	2	42

with as many as 47 students sharing access to a single micro-computer, there is only occasional waiting. However, the remaining 27% of the schools report waiting at between 20 and 36 systems per student. At the MBA level, 74% of the schools show that having 37 students sharing access to a single system results in little or no waiting. Over that point waiting occurs. Student ownership, as well as varying degrees of course

assignments requiring computer usage, confound these microcomputer density levels.

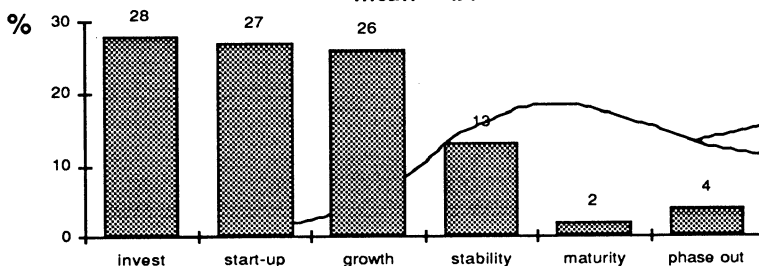
Nevertheless, combining these two sources of student data, it appears that having at most 36 students sharing access to a single system would generally result in little or no waiting. This conclusion is also supported by the historic data. In the Fifth Survey (1988), 78% of the schools reported little or no waiting for their students with a density of 40 students per system and approximately 80% of the schools the Ninth Survey (1992) reported sufficiency at 40 students per

system.

Figure 15 also shows that little further growth in the number of microcomputers can be expected, with just over 60% of the 289 schools providing data indicating that the number of their microcomputers and their computer labs is in the stability phase.

Figure 16 presents the phase data for business school owned portables and shows a phase diagram mean of 4.4 for the 260 schools reporting data. Almost equal percentages of schools are seen in the investigation, start-up and growth phases, 28%, 27%, and 26% respectively,

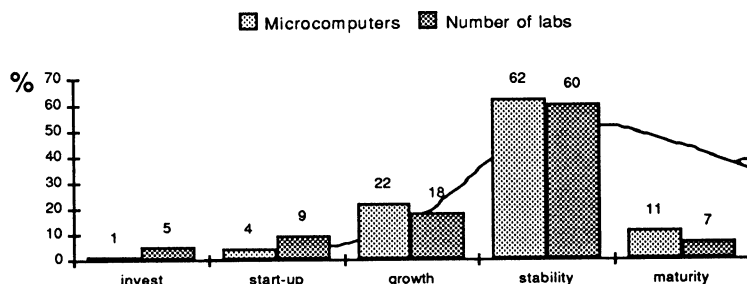
**Figure 16**  
Phases of Number of Portable Microcomputers  
N = 260  
mean = 4.4



diagrams that showed, in Table 1, significant change between the schools providing data for both the Ninth and the Twelfth Surveys. Figure 17 presents these longitudinal phase diagrams for the 97 schools, which show a mean of 4.1 in their 1992 data and a mean 5.0 in their 1996 data. This significant change may in part be attributed to the continuing advances in portable technology. However, there is some indication that the schools are not too eager to invest in these resources, and rather expect the students themselves to provide their own access to computer technology, as discussed in the following section.

Data provided by 183 business schools reflected their expectations for business school owned sub-notebook systems (systems weighing under five pounds). As can be seen in Figure 18, 90% of these schools are in the early phases related to this emerging technology, and again, there may be some hesitation in the schools' provision of these resources.

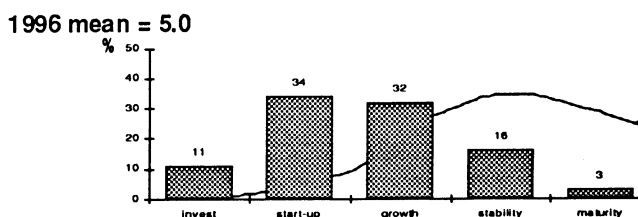
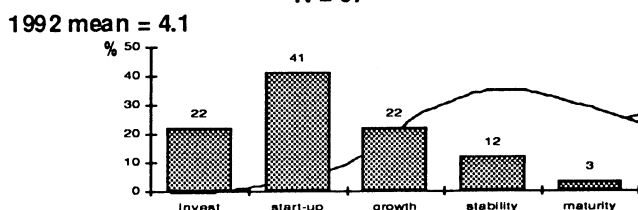
**Figure 15**  
Phases of Number of Microcomputers and Labs  
Microcomputers N = 289 Labs N = 274  
mean = 7.2 mean = 6.8



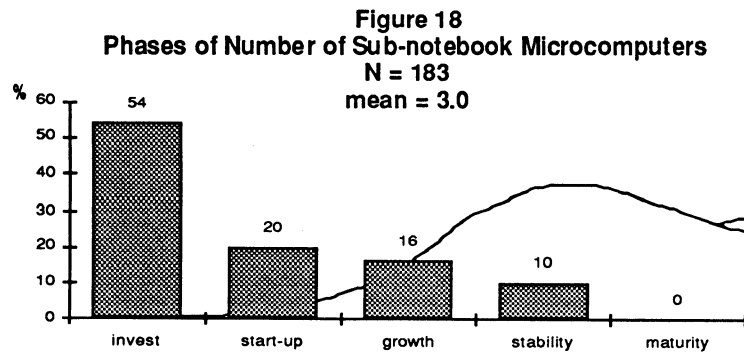
Almost equal percentages of schools are seen in the investigation, start-up and growth phases, 28%, 27%, and 26% respectively, indicating considerable interest in business school ownership of portable systems. This is balanced by 15% in the stable and late maturity phase plus an additional 4% of the schools indicating that they are actually phasing out business school ownership of these systems.

Business school ownership of portable systems is one of the phase

**Figure 17**  
Phases of Number of Portable Microcomputers  
(Longitudinal 1992-1996)  
N = 97





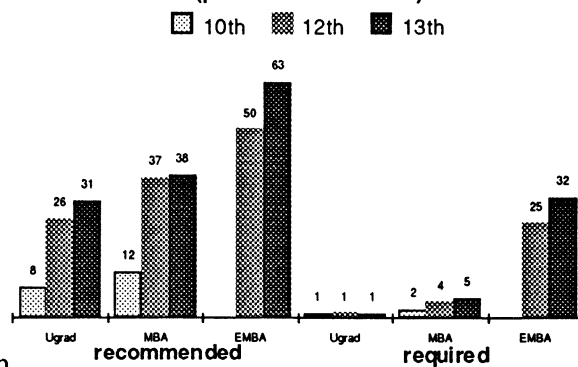


### 5.3 Student ownership

Figure 19 details the growth in recommended and required student microcomputer ownership as reported in the Tenth (1993), the Twelfth (1995), and this survey, the Thirteenth (1996). Although there has been little change at both the undergraduate and MBA levels, there have been substantial increases in recommended and required ownership at the EMBA level where recommended ownership increased from 50 to 63% and required ownership increased from 25 to 32%.

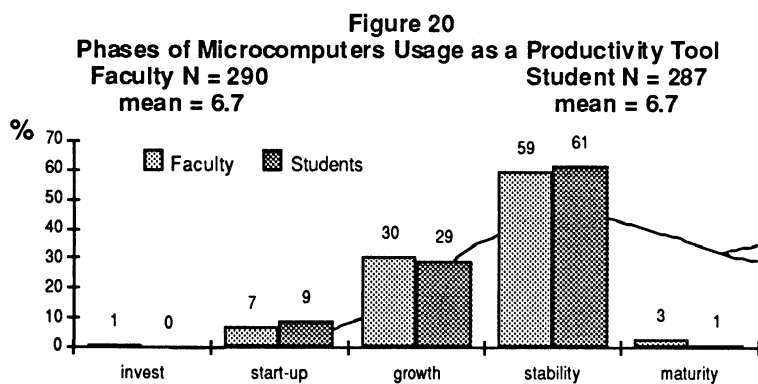
Twenty-three of the school's requiring student ownership provided make and model information. Fourteen (61%) of these schools specified laptop systems only and the remaining 39% indicated that either laptop or desktop systems were acceptable. One school specified an Apple Power Book as the only system, eight schools indicated an Apple or an Intel system, and the remaining 14 schools listed Intel only. No single Intel-based brand was dominant, with most schools responding "IBM compatible" or "any Intel."

**Figure 19**  
**Student Microcomputer Ownership**  
**(percent of schools)**



### 5.4 Microcomputer usage

A series of phase diagram questions related to microcomputer usage by the business schools faculty and students were given: productivity tool (e.g., word processing, basic spreadsheets), analytic tool (e.g., modeling, advanced spreadsheets, statistics), desktop publishing, for CD-ROM applications, and for on-line library database access. A summary phase question was related to perceptions of general computer literacy. Figures 20 through 25 present this data. None of the mean changes in these microcomputer usage phase diagrams were significant when compared to those of the Ninth Survey, whereas most all of them were between the Fifth and the Ninth Surveys.



Surveys.

Figure 20 presents the data for faculty and student use of microcomputers as a productivity tool, primarily using word processing. The faculty and the student phase diagram means for the 290 and 287 schools (respectively) reporting data was the same, 6.7 (very late growth). As in the previous surveys, evenness is shown

between faculty and student use along all the phases of the diagram, reflecting very little difference between faculty and student use of microcomputers as a productivity tool.

Figure 21 presents micro-computer use as an analytic tool, again showing the faculty and student phase means very close, % 5.8 and 5.6 (moderate growth), respectively. As in the productivity phase diagram, the faculty and students again show a general evenness across the phases, although in this analytical use diagram, 67% of the students are in the start-up and growth phases as compared to only 59% for the faculty. Slightly more faculty (6%) are shown to have reached the stable phase.

**Figure 21**  
Phases of Microcomputers Usage as an Analytic Tool  
Faculty N = 290 mean = 5.8  
Student N = 287 mean = 5.6

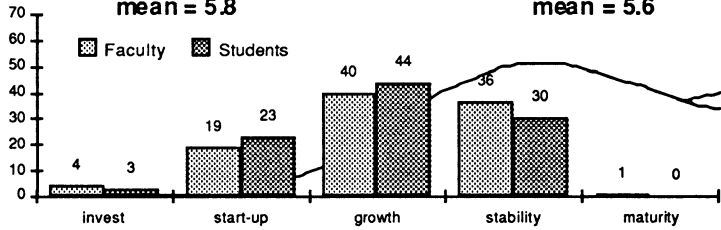
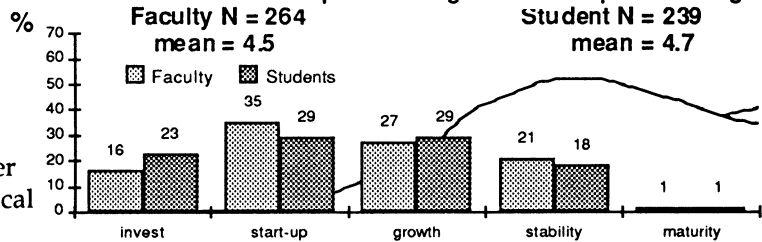


Figure 22 shows a distinctly different phase pattern than those as seen in both Figures 20 and 21. At 4.5 and 4.7, respectively, the means for both faculty and student use of microcomputers for desktop publishing are considerably lower than for productivity and analytical use. Approximately 80% of the faculty and students are in the lower phases

**Figure 22**  
Phases of Microcomputers Usage for Desktop Publishing  
Faculty N = 264 mean = 4.5  
Student N = 239 mean = 4.7



of the diagram, as compared to approximately 40% and 68% for the productivity and analytical uses respectively. Additionally, less evenness across the phases is seen in this diagram. For example, 35% of the faculty are shown to be in the up phases as compared to 29% of the students.

Figure 23 presents the phase data for the schools information about their faculty and student use of CD-ROMs. This questions was deliberately left ambiguous, open to each school's interpretation, and this year, separated out from the question regarding use of library databases. An example of an emerging CD-ROM curriculum-related use is that of interactive cases. The data in the phase diagram shows a mean of 3.9 for faculty and 3.6 for students. Reflecting the newness of this technology, all but six percent of the responding schools are in the investigation, start-up, and or early growth phases.

**Figure 23**  
Phases of CD-ROM Usage  
Faculty N = 285 mean = 3.9  
Student N = 279 mean = 3.6

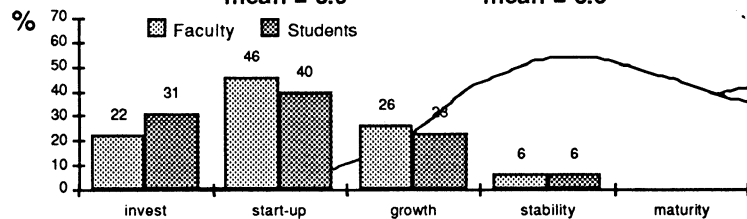
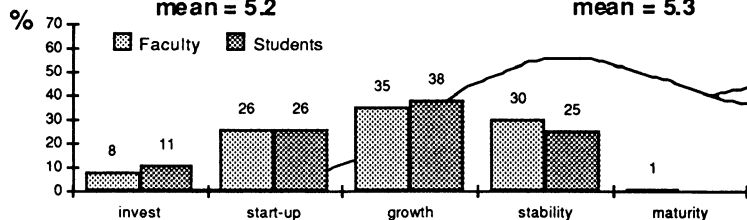


Figure 24 presents the phase data for the schools reporting about on-line library database use. These phase means of 5.2 for the faculty and 5.3 for the students are higher than those of the previous two phases, desktop publishing and CD-ROM usage. In general, evenness of use is

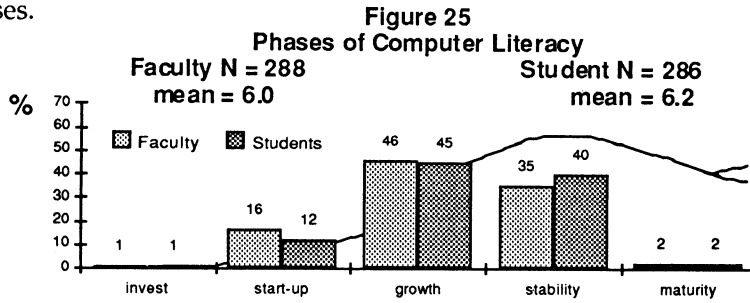
**Figure 24**  
Phases of Microcomputers Usage for On-line Database Access  
Faculty N = 284 mean = 5.2  
Student N = 277 mean = 5.3



reflected in almost all of the phases.

Figure 25, computer literacy, summarizes the schools' computer-related expectations for both their faculty and their students. As might be surmised from the patterns just seen in the specific application phase diagrams, computer literacy shows a general evenness across

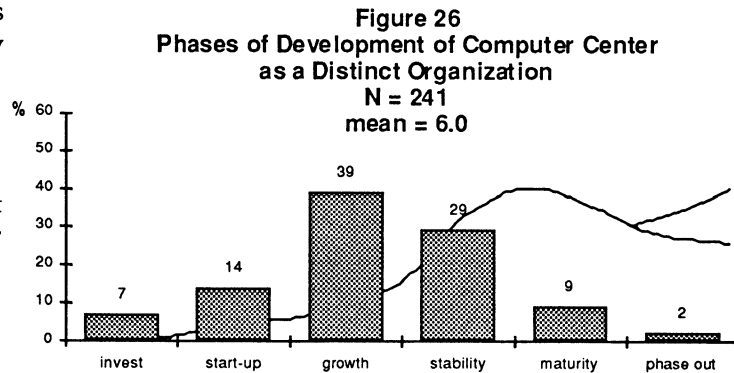
all of the phases. Faculty and student phase means were 6.0 and 6.2, respectively. However, slightly fewer faculty are seen in the stable phase, 35%, as compared to the students, 40%. Again the mean change between the Ninth and the Thirteenth responding schools was not significant, although it was for the faculty between the Fifth and the Ninth Surveys.



## 6.0 The operational level

### 6.1 Computer center

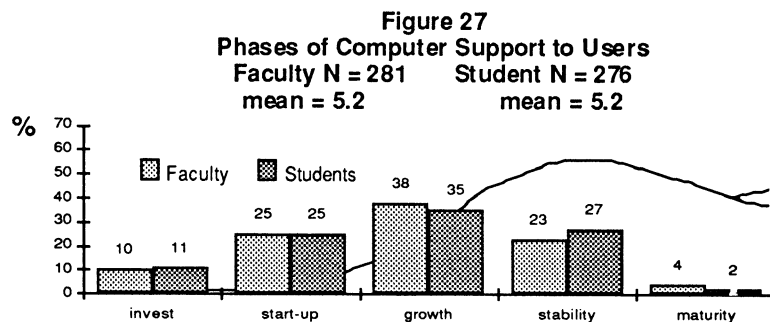
Two hundred forty-one schools reported phase data relating to the actual development of their computer center as a distinct and separate organization. As can be seen in Figure 26, 82% of the schools perceive themselves as in the start-up, growth, or stability phases. The mean of 6.0 reflects this activity. However, nine percent of the schools are in the mature phase and two percent of the responding schools report that they are actually phasing out their computer center operations.



### 6.2 User support

Although differing by individual business school, traditional user support usually takes the form of training and consulting and is perceived as a critical service of a business school's computer center. Figure 27 shows the schools' perceptions as to their provision of support separately to their faculty and their students. Although the distribution of support is quite even, as can be interpreted from the identical phase means of 5.2, there was slightly more emphasis in support for faculty, and the corresponding perception of slightly more stability in the support provided for students.

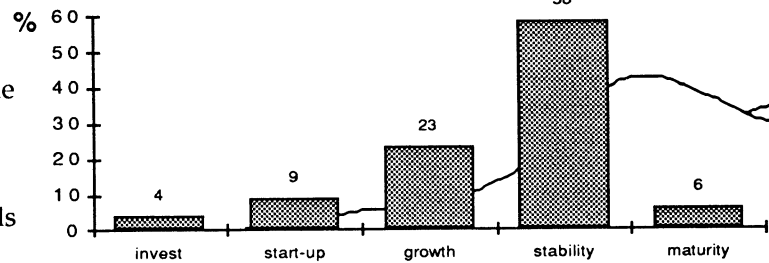
As could be expected, this phase diagram mirrors that of the development of the computer center as a distinct functional operation.



### 6.3 New technology

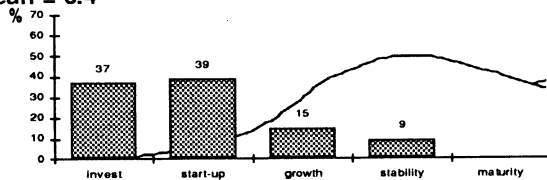
A critical function of a computing service group is supporting the introduction of new technology. Figure 28 shows the phase diagrams for Windows implementation for the 289 schools providing data for this year's survey. As reflected in the rather high mean of 6.7 (high growth), 58% of the schools indicated that they were in the stability phase and another six percent in maturity with regard to the implementation of the Windows operating system at their schools.

**Figure 28**  
Phases of Windows Implementation  
N = 289  
mean = 6.7

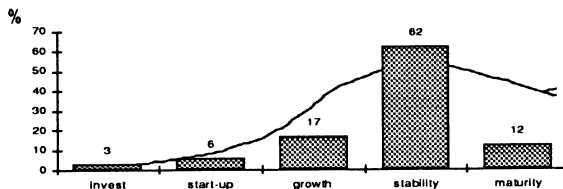


**Figure 29**  
Phases of Windows Implementation (Longitudinal 1992-1996)  
N = 103

1992 mean = 3.4



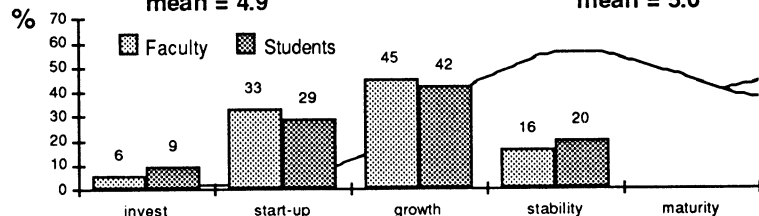
1996 mean = 7.2



The mean change of 3.9 phase units between the 1992 and 1996 data in Windows implementation was the largest and was indicated as being significant in Table 1. Figure 29 presents the phase diagrams for the 103 business schools which participated in both surveys. The differences in these phase diagrams emphasize the time and effort extended by the computer support staff to achieve this degree of technological change and just how quickly major technological changes can occur within the schools.

Another new technology requiring considerable effort from the computer support staff is the implementation of multimedia systems. The phase diagram data for both the faculty and students is given in Figure 30. The means of 4.9 and 5.0 indicate that both are just entering the growth phase in the use of this new technology.

**Figure 30**  
Phases of Multimedia Systems Implementation  
Faculty N = 288  
Student N = 282  
mean = 4.9  
mean = 5.0



### 6.4 Computer center operational issues

The survey questionnaire presented a list of thirty-one issues concerning operation of the business school computer center from which the respondent schools selected and ranked the ten most critical to their school. Table 9 ranks the issues identified by one third or more of the responding schools, and compares these rankings with those of the Ninth and Fifth Surveys.

Although lower in ranking in the Ninth Survey, the provision of adequate faculty training returned to the most critical issue in this year's survey as it had been in the Fifth Survey eight years ago. Equipment maintenance has remained consistently as the second most critical issue in all three of the surveys. The third and fourth critical issues both concern hardware this year, and the following four software. This is related in part to the introduction of Windows 95 which

**Table 9**  
**Business School Computer Center Operational Issues**

Issue	1996 N = 282		1992 N = 165		1988 N = 175	
	Rank	%	Rank	%	Rank	%
Providing adequate faculty training	1	73	4	57	1	64
Equipment maintenance	2	61	2	63	2	60
Not enough hardware to meet demand	3	56	11	42	8	47
Incompatible hardware	4	55				
Not enough software to meet demand	5	53	13	36	5	52
Acquiring software site licenses for school	6	49	5	53	3	57
Incompatible operating systems	7	45				
Illegal copying of software	8	44			13	40
Sufficient space for computing facilities	9	43	8	48	3	57
Creating a realistic budget, identifying the real costs	9	43	5	53	11	42
Role of mini/mainframes	11	42			11	42
Providing adequate student training	12	41	3	61	5	52
Matching technology to user needs	13	36	9	47	9	47
When to upgrade equipment	14	35	9	47	5	52
Finding and/or retaining technical staff	15	34	13	36	10	43

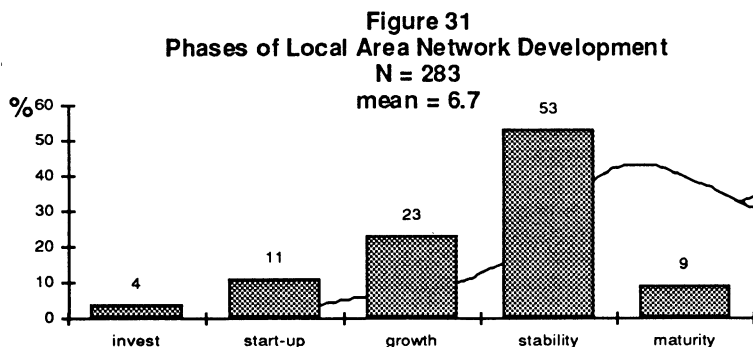
requires a computer configuration that exceeds that of the previous operating systems and which does not run many of the legacy DOS-based programs. Sufficient space and the creation of realistic budgets, now tying for the ninth rank, are showing less of a sense of criticalness than in previous years. Student training, previously ranked as 3rd and 5th in the Ninth and Fifth Surveys respectively, seems to be approaching resolution, perhaps reflecting that business students are entering with rather sophisticated, or at least adequate, computer skills. Equipment obsolescence, which was ranked number 1 in the Ninth Survey, was not identified as a critical issue this year.

## 7.0 Communication and networks

### 7.1 Development and use of local area networks

Figure 31 presents the phase diagram for the 283 business schools providing data regarding the development of their local area networks (LAN). Sixty-two percent of these schools report being in the stable or mature phase as to the development of their LAN infrastructure, and 23% report as being in the growth phase. Only 15% of the responding schools perceive themselves as in the investigation or early start-up phases.

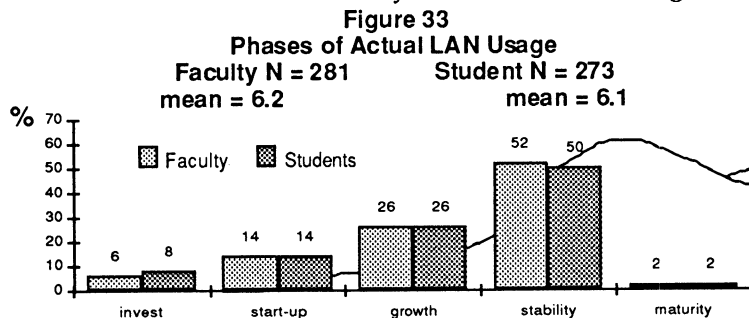
Table 1 showed that the mean change of 1.7 phase units was significant at the 0.001 level for the 106 schools providing this data in both the Ninth and Thirteenth Surveys. As the LAN development mean change was also significant between the schools responding in both the Fifth



and the Ninth Surveys, the data was plotted for the sixty-three schools that provided LAN development data in all three of the "where"-oriented surveys. Figure 32 presents this longitudinal view of these significant changes across the last eight years. As can be seen, the business schools proceeded along the LAN

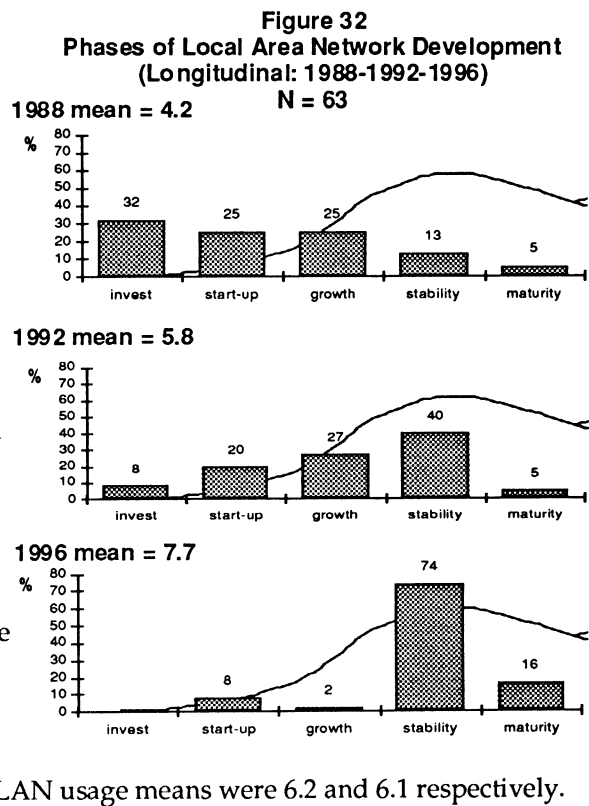
development growth in a logical sequence, with the 1988 phase diagram showing 82% of the schools in the early phase of investigation, start-up, and/or growth, the 1992 phase diagram showing 55% of these same schools in these early phases, and the 1996 phase diagram showing only ten percent of the schools in these early phases. The means reflect this development from late start-up (4.2), through fast-growth (5.8), to stability (7.7).

However, the development of an infrastructure does not necessarily guarantee use. Thus, the business schools were also asked about their perceptions of actual LAN usage by their faculty and students. Figure 33 summarizes these responses. As again reflected in the similarity of the means, the faculty and student actual usage is almost identical across the phases, with 54% of the faculty and 52% of the students being perceived in the stable or mature phases. And, as could be expected, the actual faculty and student use of the LANs is lagging slightly behind the development of the LAN infrastructure. The LAN development phase mean was 6.7 whereas the faculty and student LAN usage means were 6.2 and 6.1 respectively.

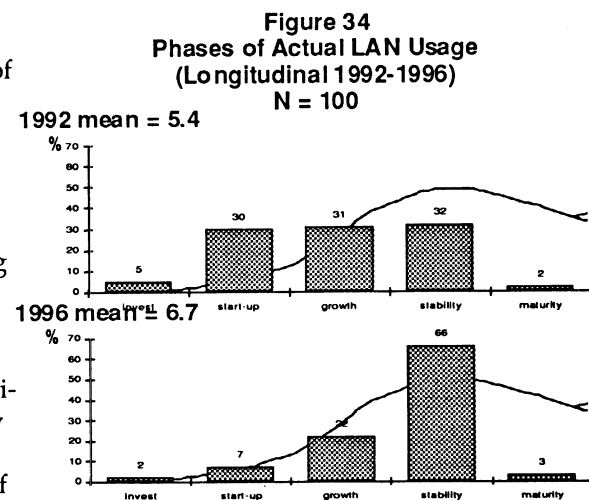


usage was collapsed to allow comparison with the Ninth Survey data. Figure 34 presents the diagrams of this significant LAN usage mean change for the 100 schools providing data in both surveys. Thirty-four of the responding schools perceived themselves as being in the stable or mature phases in 1992 as compared with 69% of them in the 1996 data.

Table 10 summarizes the access to the LANs by the business schools' faculty and students. The magnitude of connectivity is shown in the far right column, where it can be seen that over 75% of the 286 schools providing data responded that all of their student labs, faculty offices, and administrative offices were networked, and 68% reported that all of these distinct LANs were bridged together. Comparison of the data between all of the Ninth Survey business schools and all of the Thirteenth Survey schools shows that connectivity of all of



As with the development of the LAN infrastructure, the mean phase change of actual usage of the LAN usage was also significant for the schools providing data in both the Ninth and the Thirteenth Surveys. The Thirteenth Survey data which was broken out by faculty and student LAN



**Table 10**  
**User Access to LANs**  
**(percent of users)**  
**N = 286**

	N	None	Some	All
Student labs	286	3.5	11.5	85.0
Faculty offices	286	6.3	17.8	75.9
Administrative offices	285	5.3	13.7	81.1
Classrooms	284	15.5	48.2	36.3
Are these LANs bridged together?	268	9.3	22.4	68.3

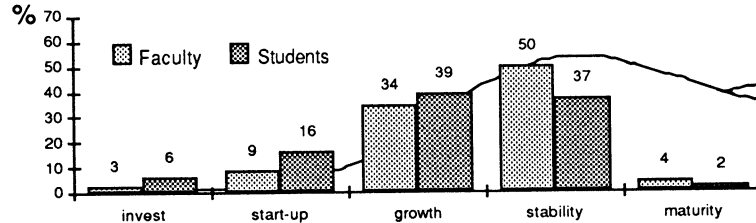
student e-mail usage data for the 289 and 282 business schools, respectively, providing data this year. As seen in the figures reflecting overall usage of the LAN, this specific application can also be seen to lag behind the development of the schools' LAN infrastructure.

Both the faculty and student mean phase changes were significant between the

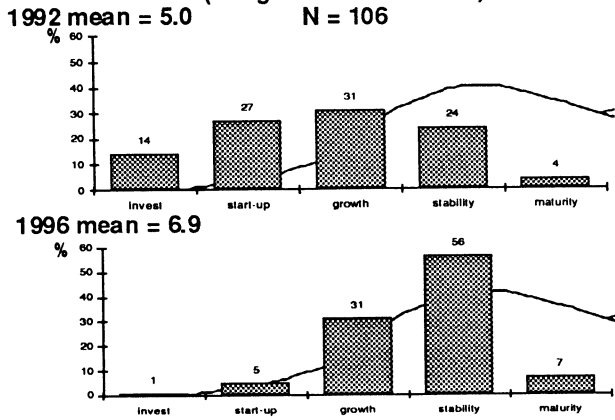
the student labs changed from 64% to 85%, faculty offices from 38% to 76%, and administrative offices from 47% to 81%. The bridges between these LANs changes from 42% to 68%. The next obvious growth in LAN connectivity can be projected to be with the classrooms, as only 36% of the schools responded that their classrooms were connected to the LAN.

Faculty and student use of e-mail reflects a specific application of the LANs. Figure 35 presents the faculty and

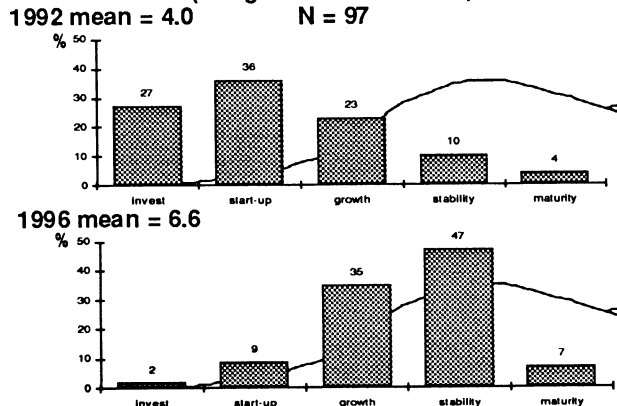
**Figure 35**  
**Phases of E-Mail Usage**  
**Faculty N = 289**      **Student N = 282**  
**mean = 6.5**              **mean = 5.8**



**Figure 36**  
**Phases of Faculty E-Mail Usage**  
**(Longitudinal 1992-1996)**  
**N = 106**



**Figure 37**  
**Phases of Student E-Mail Usage**  
**(Longitudinal 1992-1996)**  
**N = 97**



Ninth and the Thirteenth surveys for e-mail usage. Figures 36 and 37 show the longitudinal phase diagrams. Close consideration of these two longitudinal phase diagrams shows that although the faculty 1996 mean of 6.9 is slightly greater than that of the 1996 student mean of 6.6, more growth was seen for the students than for the faculty. The student mean change was 2.6 phase units compared to 1.9 for the faculty.

## 7.2 Communication and network issues

The survey questionnaire presented a list of twenty-three communications and network issues from which the respondent schools were asked to select and rank the seven most critical. Table 11 lists the issues identified by a third or more of the responding schools, and compares these rankings with those of the Ninth and Fifth Surveys. As in the Ninth Survey, network management was considered to be the most critical issue, and network reliability the third most critical. Software licenses and software availability for networks, and operating networks in a lab setting, have remained

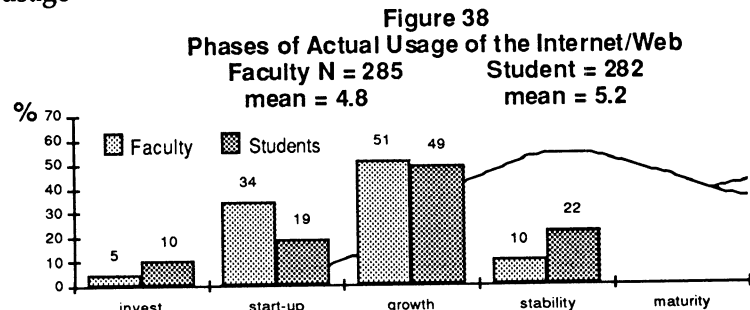
**Table 11**  
**Communication and Network Issues**

Issue	1996 N = 269		1992 N = 164		1988 N = 175	
	Rank	%	Rank	%	Rank	%
Network management	1	71	1	74		
Remote individual connectivity (PPP, SLIP, telnet)	2	55				
Reliability of network	3	51	3	48		
Response time on network	4	43	6	37		
Software licenses for use on a network	5	39	2	56	1	98
Multimedia over network	6	37				
Software availability for use on a network	7	35	5	38	3	85
Laptop connectivity to network	8	33				
Operating network in lab setting	8	33	6	37	6	73

since the Fifth Survey, but issues such as remote individual and laptop connectivity, as well as the use of multimedia on the network, are now also being considered critical. Other issues suggested by some of the schools including the problem of upgrading older equipment to become compatible with the network environment and increasing the bandwidth, either through the campus backbone or through the business school.

### 7.3 Web development and usage

The Internet and World Wide Web are becoming frequently used resources by business school faculty and students. Figure 38 presents the phase diagram for faculty and student Internet/Web usage. It is interesting to note that there is a larger percentage of faculty in the start-up and growth phases than for students, 85% for faculty compared with 68% for students. Furthermore, the schools perceive that there are 12 percent more students in the stable phase than faculty. Thus, the student phase mean is higher than the faculty phase mean, 5.2 and 4.8 respectively.



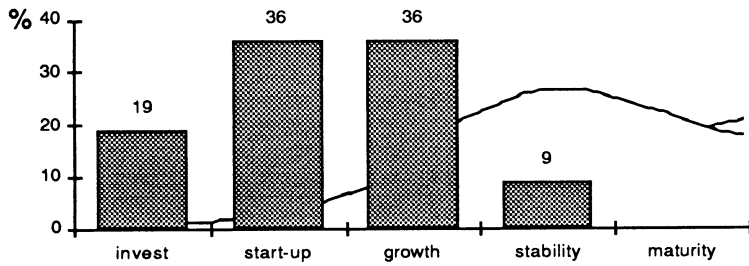
Use of the Internet and Web can be independent of a school's own Web infrastructure and the content on its Web site. Anyone with a computer and modem can "surf the Web" using numerous access points via an Internet account available from school, or commercially from AOL, CompuServe, and many local telephone companies.

Even though faculty and students make use of the Internet and Web, business school commitments and policies are still in the formative stages. When presented with a list of eleven reasons as to why their schools were developing a Web site, only three reasons were identified by at least one-third of the 266 schools providing data: increase to information access (75%), student recruitment (74%), and as necessary to keep up with their competitors (46%). Schools currently do not yet consider the Web as a means of establishing stronger ties to the corporate community, placement recruiters, or alumni, nor to building stronger internal communications as reasons for Web site development.

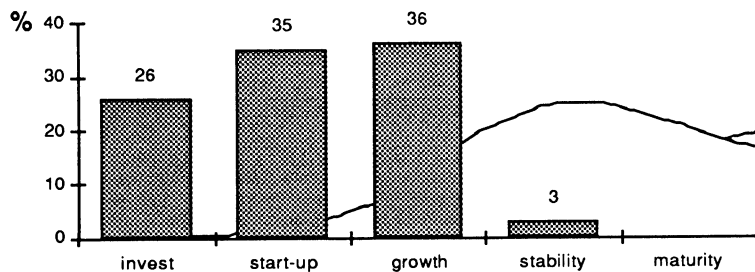
Web site infrastructure refers to the Web server hardware and software necessary for a site to be accessed. Figure 39 shows the 275 responding business schools' perceptions related to the development of their Web site infrastructure. The mean of 4.2 (late start-up phase) is a summary indicator that the schools, in general, are in the earlier phases of development. This is confirmed by only 9% of the schools reporting being in the stable phase, while 72% reported being in the start-up and growth phases.



**Figure 39**  
**Phases of Web Infrastructure Development**  
 N = 275  
 mean = 4.2



**Figure 40**  
**Phases of Web Site Content Development**  
 N = 283  
 mean = 3.8



Web content development refers to the initial placing of material onto a school's Web site whereas Web maintenance reflects the need to periodically revisit and update this content material. Figure 40 presents the schools' responses to the phase question about their Web site content development. Of the 283 responding schools, the overall phase mean is 3.8 (late start-up). Only 3% of the schools perceived themselves in a stable phase, while once again 72% are actively developing their content as indicated by their placements in the start-up and/or growth phases.

Table 12 summarizes those responsible for both developing and maintaining the schools' Web sites. The schools were asked to spread their development sources by

percentage across the areas, to total one hundred percent. Thus for each area the mean percent of the spread is given. As can be seen in the development-related columns, 163 business schools gave a mean percent of 45 to their faculty as the initial developers of their Web sites. Fewer schools, 117, gave a larger mean percent to the computer center as responsible for the initial development of their Web sites. Eighty-one schools indicated that the central campus took a

central role in the development process. Another larger mean percentage of the responsibility was given to an outsourced vendor, but by relatively few schools. As may be seen in this table, there is no single source as yet designated to develop the schools' Web site. A similar conclusion may be made regarding the maintenance of the schools' Web sites, although the computing center, faculty members, and the central campus again took larger mean percentages of responsibilities.

**Table 12**  
**Web Site Development and Maintenance**

	Development N=276	mean %	Maintenance N=259	mean %
B-school				
computing services	117	56.7	105	45.8
external affairs	27	27.8	29	36.9
faculty members	163	45.1	163	44.5
students	93	28.7	87	28.0
administrative staff	92	31.7	108	40.3
Central campus groups	81	61.0	63	61.3
Outsourced	13	45.9	13	38.5

A Web site can be set up so that access is available to anyone from anywhere, generally referred to as Internet access. On the other hand, access can be limited to a specific group of individuals or restricted locations, often referred to as Intranet access. Table 13 summarizes the content available on the schools' Web sites by Internet and Intranet access. Also, since so many of these areas are open to debate within the schools, if the material is not currently available, the respondents were asked if the material would be made available at some future time or if that

**Table 13**  
**Web Site Content Availability**

	N	Internet access	Intranet access only	Not available	No decision yet
Catalog materials	270	71.1	4.1	14.8	10.0
Faculty personal pages	277	53.1	5.1	23.5	18.4
Faculty resume pages	271	52.0	7.0	25.8	15.1
Student club materials	267	49.1	6.7	24.3	19.9
Teaching (syllabi, old exams)	273	39.6	14.3	27.8	18.3
Alumni news	259	37.5	5.0	33.2	24.3
Student personal pages	272	33.1	5.9	36.4	24.6
Student resume pages	271	28.8	7.7	39.1	24.4
Job postings	261	28.7	11.1	35.6	24.5
Staff personal pages	264	26.9	4.5	45.1	23.5
Staff resume pages	263	20.9	4.2	51.3	23.6

decision had not yet been made. The most common content available via Internet access was catalog material, provided by 71% of the 270 schools providing data. This was followed by faculty resumes and personal pages, provided by 53% and 52% each of the responding schools, and then student club materials. In general, there were very low percentages of schools which seemed to restrict their materials to Intranet access only. Of these, the most common was teaching materials, in the form of syllabi and old exams, restricted by 14% of the 273 responding schools, and job postings, restricted by eleven percent of the 261 responding schools.

The phase of Web content development (Figure 40) and the table describing actual content availability (Table 13), may at first glance, appear contradictory. However, it is important to recognize that the content development of a Web site is very difficult to judge. A school may have one hundred pages on its Web site and easily rate itself as in the start-up phase.

In response to the question of what data formats were used to display their Web pages, the schools were asked to spread one hundred percent across text, graphics, animation, video and sound. As shown in Table 14, text showed the highest mean percentage at 76%, followed by graphic media with a mean of 23%. Few schools provide video, sound or animation on their Web sites.

The survey questionnaire also asked about Web-related services provided by the business schools. Table 15 summarizes these responses. Of the 277 schools providing data about training, 52% provided access and retrieval training and 32% provided Web page development training. Additionally, about 30% of the responding schools provided some sort of user guide or documentation.

**Table 14**  
**Web Site Media**

	N	mean %	range
Text	246	75.8	5 to 100%
Graphics	230	22.5	2 to 95%
Animation	30	7.0	1 to 20 %
Video	41	6.8	1 to 30%
Sound	42	4.5	1 to 20%

**Table 15**  
**Web-related Services**

	N	%
Access/surfing training	277	52.3
Page development training	277	32.1
User guide/documentation	273	28.9
On-line admissions form	270	21.5
Commerical server	269	9.7

## 8.0 Cluster analysis

Recognizing that business schools had started their computerization process at different times, with differing resource bases, and with differing objectives, it is reasonable to assume that the schools could be grouped according to *where* they were in the computerization process. In the Fifth Survey (1988), the 172 participating business schools grouped into five clusters based on the similarity of responses to 21 phase questions and, in the Ninth Survey (1992), a different sample of 175 business schools again grouped into five clusters based on 30 phase questions. The results of both of these Surveys showed that the business schools in the different clusters had differing issues and concerns.

This year, using the same cluster analysis procedure (SAS FASTCLUST) as for the Fifth and Ninth Surveys, the 286 participating business schools were grouped according to their similarity of responses to the 43 phase questions. And again, five distinct clusters emerged from the data

provided by the schools. (Seven schools failing to achieve cluster membership because of insufficient data.) As shown in Table 16, four of these clusters, Start-up, Mixed, Late Growth, and Stable, had means the same as or very close to those found in both the Fifth and the Ninth Surveys. No cluster showed a mean close to the previous Early Growth mean. Rather, the fifth cluster was beyond that of the previous Stable cluster mean and formed a new cluster category, Mature. This cluster appears to reflect the natural progression along the phase diagram, and though totally unexpected, is quite logical. Close consideration of a six cluster solution still showed the distinctive gap between the Start-up and the Mixed clusters. Thus, the decision was made to stay with the five cluster solution.

**Table 16**  
**Comparison of Clusters (1988-1992-1996)**

		Fifth 1988	Ninth 1992	Thirteenth 1996
Start-up	N	51	42	63
	mean	4.2	4.3	4.0
Early Growth	N	19	19	
	mean	4.5	4.8	
Mixed	N	40	42	37
	mean	5.3	5.2	5.2
Late Growth	N	36	41	91
	mean	5.6	5.6	5.5
Stable	N	26	31	67
	mean	6.5	6.6	6.5
Mature	N			28
	mean			7.2

As with the Fifth and Ninth Surveys, school cluster membership remains confidential, being sent privately to each school in the cover letter that accompanies the distribution of this survey report.

### 8.1 Cluster demographics

General demographics for each cluster are given in Table 17. Sixty-three schools grouped into the cluster identified as Start-Up with an overall mean of 4.0 (4.2 in the Fifth Survey and 4.3 in the Ninth Survey). The overall phase mean for this cluster indicates that these schools are in the early phase of computerization, just getting started with many of the various computerization processes. As can be seen in the range of phase means given in Table 17, this Start-up cluster's highest phase mean was only 6.1.

No cluster was generated whose mean fit into the Early Growth category as identified in the earlier surveys (4.5 in the Fifth Survey and 4.8 in the Ninth Survey). Thirty-seven schools grouped into a cluster identified as Mixed with an overall mean of 5.2 (5.3 in the Fifth Survey and 5.2 in the Ninth Survey). As in the previous surveys, the Mixed cluster showed a flatter profile than any of the others and a wider spread of phase means, not quite as far along in some phase areas, yet farther in others. The Mixed cluster is placed before the Late Growth cluster because of its lower overall phase mean.

**Table 17**  
**Demographics by Cluster**  
**(N = 286)**

	<b>Start-Up</b>	<b>Mixed</b>	<b>Late Growth</b>	<b>Stable</b>	<b>Mature</b>
Cluster size	N = 63	N = 37	N = 91	N = 67	N = 28
Phases mean (range)	4.0 (1.6-6.1)	5.2 (1.5-7.9)	5.5 (2.6-8.7)	6.5 (4.4-10.1)	7.2 (5.0-9.1)
Type					
Public	44%	79%	62%	62%	64%
Private	48	16	38	30	36
No data	8	5		8	
Programs					
Ugrad only	5%	16%	13%	12%	7%
Both	82	73	74	68	79
Grad only	5	0	7	12	10
No data	8	11	6	8	4
Student FTE (range)	1285 (44-5291)	1579 (262-3670)	1664 (160-6300)	1654 (27-5954)	2000 (114-6400)
\$/student (range)	149 (2-2203)	117 (3-825)	221 (5-1603)	471 (6-3670)	333 (21-2050)
Student/micro (range)	51 (1-237)	30 (3-189)	44 (5-605)	17 (1-116)	22 (1-77)
Faculty/micro (range)	2.7 (.1-41.7)	1.1 (.6-4.6)	1.4 (.3-10.8)	0.8 (.2-1.5)	0.9 (.4-2.6)
Rec/req ownership					
Ugraduate	18%	22%	33%	26%	49%
Graduate	37	22	39	39	60
Executive	19	19	21	31	57

Ninety-one schools grouped into a cluster identified as Late Growth with an overall mean of 5.5 (5.6 in the Fifth Survey and 5.6 in the Ninth). Continuing with an interpretation of more development in the process of computerization, sixty-seven schools grouped into a cluster identified as Stable with an overall mean of 6.5 (6.5 in the Fifth Survey and 6.6 in the Ninth). The final and newly emergent cluster in this year's survey, labeled as Mature, is comprised of twenty-eight business schools with an overall phase mean of 7.2.

The Mixed cluster was comprised of almost 80% public schools while the Start-up cluster schools were almost evenly balanced between public and private schools. The Mixed cluster was distinctive in having no graduate only programs, a slightly larger percentage of undergraduate only programs and a tighter range of student FTE. Both the Stable and the Mature clusters had larger percentages of graduate only programs and higher average computer operating budget expenditures per student. The Start-up cluster showed the highest microcomputer densities. The Mature cluster showed the highest percentage of their schools as requiring or recommending student microcomputer ownership.

## 8.2 Cluster phase means

As part of the clustering process, a mean for each of the 43 phase questions was generated, summarizing *where* each cluster is in the computerization process for each phase. Figure 41 presents the complete profile for each cluster, with each phase mean represented by an abbrevi-



**Table 18**  
**Issues by Cluster**

<b>Start-up</b> N = 63 mean = 4.0	<b>Mixed</b> N = 37 mean = 5.2	<b>Late Growth</b> N = 91 mean = 5.5	<b>Stable</b> N = 67 mean = 6.5	<b>Mature</b> N = 28 mean = 7.24
		<b>STRATEGIC</b>		
Curr devel	Funding	Curr devel	Curr devel	Funding
Funding	Curr devel	Funding	Funding	Technology
Technology	Technology	Web site	Technology	Distance
Lack goals	Fincntives	Technology	Distance	Curr devel
Distance	Distance	Fincntives	User expect	Web site
Fincntives	Web site	Distance	Web site	User expect
Org structure	S fees	Lack goals	Org structure	Admin systems
User expect	Standards	User expect	Fincntives	Fincntives
		<b>INSTRUCTIONAL</b>		
F style	F style	F incntives	F style	F incntives
F incntives	F incntives	F style	F incntives	F style
PC in cls	Amt integr	Amt integr	Amt integr	Amt integr
F techchange	Funding	F techchange	F techchange	CW dev support
Funding	CW dev support	Funding	CW dev support	F techchange
Amt integr	F techchange	PC in cls	Funding	Funding
		<b>OPERATIONAL</b>		
F training	F training	F training	HW maintence	F training
Insuff HW	HW maintence	Cls support	Consulting	HW maintence
Real budget	Real budget	HW maintence	Cls support	Stf currency
User needs	User needs	Consulting	F training	Web standards
HW maintence	When upgrade	Real budget	Real budget	Staff burnout
Insuff space	Cls support	Insuff space	Tech staff	Insuff HW
S training	Stf currency	Insuff HW	Stf currency	Real budget
S training	SW licenses	S training	When upgrade	When upgrade
Consulting	Consulting	When upgrade	Insuff HW	Tech staff
When upgrade	Web standards	Tech staff	Insuff space	Insuff space
Tech staff	S training	Stf currency	Web standards	Consulting
		<b>NETWORK</b>		
NW mgmt	NW mgmt	NW mgmt	NW mgmt	NW mgmt
Reliability	Reliability	Remote con	Remote con	Remote con
Network software	Remote con	Response time	Laptop con	Reliability
Remote con	Network software	Reliability	Reliability	Laptop con
Net in lab	SW licenses	SW licenses	Response time	Access security
Net multimedia	Response time	Net multimedia	Net in lab	Response time
Response time	Net multimedia	Network software	SW licenses	Net multimedia
SW licenses	Laptop con	Net in lab	Net op sys	Expansion nodes

ated description (defined in Appendix 2) as in Figure 1. In Figure 41, the clusters show a gradual pattern of progression along the phase diagram. For example, the Start-up cluster with an overall phase mean of 4.0, shows the largest number of phase areas in the Start-up phase at 4, whereas the Late Growth cluster with an overall phase mean of 5.5 shows the largest number of phase areas in the Growth phase at 5, the Stable cluster with an overall phase mean of 6.5 at the Growth phase 6, and the Mature cluster with an overall phase mean of 7.2 at the Stable phase of 7. The profile of the Mixed cluster is much flatter with the same number of phase areas at 3, 5, and 7.

Additionally, a similar progression may be seen for the individual phase areas. For example, Sub Port (the number of sub-notebook microcomputers) is in phase 2 for the Start-up cluster (and even phase 1 for the Mixed), then progresses along to be at phase 3 for the Late Growth cluster, and at phase 5 for both the Stable and the Mature clusters. Similarly, Web cont (development of Web content) is shown at phase 3 for both the Start-up and the Mixed clusters, at phase 4 for the Late Growth cluster, and at phase 5 for the Stable cluster, and at phase 6 for the Mature cluster.

### 8.3 Issues by clusters

Table 18 separates the four issue areas (strategic, instructional, operational, and network) discussed previously, presenting the issue by cluster and in the order as ranked by the cluster. The abbreviations used in this table are given in Appendix 2.

Among the strategic issues, five issues were of concern across all of the clusters although given different overall rankings as to importance: appropriate curriculum development utilizing computing (Curr devel), adequate funding for operational support (Funding), keeping current on what technology is appropriate (Technology), distance education/learning and teleconferencing (Distance), and faculty incentives for courseware/integration (Fincentives). These issues seem to be independent of *where* the schools are in the computerization process. Funding, curriculum development and faculty incentives were also identified by almost all of the clusters in the Fifth and the Ninth Surveys, further evidence that these issues have not yet been resolved. However, distance learning is a relatively new strategic issue and, although recently emergent, is identified as critical for all of the clusters and again as independent as to *where* the schools are in the computerization process.

In contrast, Web site (Web site development), also a newly emergent strategic issue, is shown as critical only for the four later clusters, whereas the Start-up cluster and several of the middle clusters are still concerned with Lack goals (lack of goals and/or strategic planning) and Org structure (Business school's computing services organizational structure). Obtaining hardware/software donations, seen as a critical strategic issue in the Ninth Survey, has completely dropped out. The single issue unique to the Mature cluster is Admin systems (administrative systems development).

Major operational issues identified by all of the clusters were F training (providing adequate faculty training), Real budget (creating a realistic budget, identifying the real costs), HW maintenance (equipment maintenance), Consulting (providing help desk/general consulting), and When upgrade (when to upgrade equipment). Although the only one of these in the Ninth Survey was HW maintenance, these seem to be issues again independent of where the school is in the computerization process. The provision of adequate student training (S training) was an area critical to all of the clusters in the Ninth Survey, but now appears only as critical in the Start-up, Mixed, and Late Growth clusters. Acquisition of software site licenses (SW licenses), again critical across all of the clusters in the Ninth Survey, only appears as important this year in the Mixed cluster. And, equipment obsolescence, also appearing across all of the clusters in the Ninth Survey, has totally dropped out in this year's summary by cluster.

Web standards (establish Web site standards) and Stf currency (computer staff training/keeping current) appear in the clusters farther along the phase diagram, although Tech staff (Finding and/or retaining technical staff), Insuff HW (not enough hardware to meet demand), and Insuff space (sufficient space for computing facilities) appear in all but the Mixed cluster. Staff burnout (computer staff burnout/morale) is an issue unique to the Mature cluster.

Regarding the communications and network issues, NW mgmt (network management) is again common across all of the clusters as in the Ninth Survey. However in this year's survey Reliability (reliability of the network), Response time (response time on network), and Remote con (remote individual connectivity -- PPP, SLIP, telnet) were also identified as critical across all of the clusters independent of *where* the clusters were in the computerization process. Network software (software availability for use on a network) and SW licenses (software licenses for use on a network) were shown as areas of concern only in the clusters lower on the phase diagram, whereas Laptop con (laptop connectivity to network) appeared as critical in those higher along

the phase diagram. Access security (access security/password encryption/firewall) and Expansion nodes (adding nodes to the network) only appeared in the Mature cluster.

The instructional issues showed very little variation between the clusters. Major issues are centered around the faculty across all of the clusters: F style (teaching style/motivation to use technology), F incentives (faculty incentives for developing courseware), and F techchange (inability of faculty to keep up with technological change). Amt integr (defining an appropriate level of curriculum integration) and Funding (lack of funds for curriculum support) were also shown across all of the clusters. PC in cls (inability to use computers in the classroom) was unique for the Start-up and the Late Growth clusters and CW dev support (courseware development support) was unique in the Mixed, Stable and Mature clusters.

Thus, in summary, across all of the areas, whether strategic, instructional, operational, or network, some issues are seen to be more independent of *where* the business schools are in the computerization process. These issues include the strategic issues of funding, curriculum development, technological currency, distance education, and faculty incentives, the operational issues of hardware maintenance and upgrades, providing adequate faculty training, establishing a realistic budget, and providing help desk and general consulting, the network issues of general network management, network reliability and response time, and remote individual connectivity, and the instructional issues of identifying the appropriate amount of computer integration, faculty incentives, teaching style, and keeping up with technological changes, and curriculum support funding.

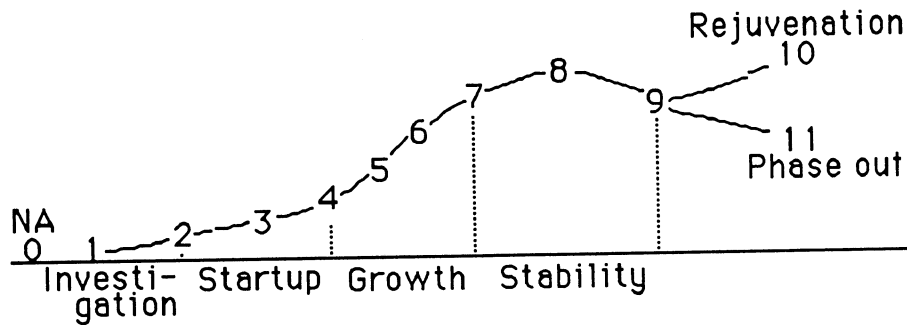
Other issues show clearer relationships to *where* the schools are in the process of their computerization. These issues include the strategic issues of lack of goals and concern with organizational structure identified by the earlier clusters and Web site development and administrative systems developments identified by the later clusters, the operational issues of student training identified by the earlier clusters and insufficient hardware, staff currency, Web standards identified by the later clusters, and staff burnout unique to the Mature cluster, the network issues of software and licensing identified by the earlier clusters in contrast to laptop connectivity identified by the later clusters, and access security and expansion unique to the Mature cluster, and the instructional issues of inability to use computers in the classroom identified by the earlier clusters and the problems of courseware development identified by the later clusters.

Finally, some issues seem to have been resolved during the past eight years. The Ninth Survey identified the strategic issues of lack of short term plans and school-wide hardware and software standards, the operational issues of illegal copying of software, insufficient software, and the role of the mini/mainframes, the network issues of data security, incompatibility of competing network technologies, and basic microcomputer connectivity, and the instructional issues of courseware design. Issues that have become less critical between the four years of the Ninth and the Thirteenth Surveys include the strategic issue of concern (hope) for hardware and software donations, and the operational issues of student training, equipment obsolescence, software licenses, Windows implementation, and graphics, the network issues of micro to mainframe connectivity and WAN access. The instructional issues remain exactly the same as they were four years ago, indicating that these are primarily issues that cannot be solved by technological advances, learning curves, or even time in the computerization process.



## Appendix 1

### Business School Computerization Life Cycle



#### Phase Definitions:

- 0 **Not applicable:** not appropriate for our business school at this time, no interest or use
- 1 **Investigation:** gathering information, thinking about ideas
- 2 **Initial action:** selection between alternatives, seeking support, grant activities, obtaining bids, general preparation, one/two experimenters
- 3 **Start-up:** initial installation, testing, working out bugs, several users
- 4 **Introduction to users:** developing support, identifying day-to-day needs
- 5 **Slow growth:** minimal expansion, initial acceptance, insufficient resources to meet demand
- 6 **Fast growth:** rapid expansion of resource, growing demands and expectations
- 7 **Maturity:** beginning of steady state, continuity of services, routine patterns have emerged, stable user base, resource usually meets demand
- 8 **Institutionalized:** little expansion, routine replacement of obsolete technology or system, expectation is "this is the way it ought to be"
- 9 **Choice point or decline:** technology or system in place is declining in use or resource is not effectively being used prompting a review of the status quo and consideration of alternatives
- 10 **Rejuvenation:** renewed interest, excitement, new expansion, new applications and users
- 11 **Phase out:** discontinued use, replaced by new technology or system

## Appendix 2

### Phase Diagram Question Definitions and Usage Across Surveys

5th 1988	9th 1992	13th 1996		
*	*	*	Budget	Computer support operating budget
*	*	*	Cls Eqp	Electronic/computer-linked equipment in classroom
		*	CompCen	Computer center/services organization
	*	*	Curr Imp	Computer integration impact on the curriculum
*	*	*	Curr Int	Computer integration into curriculum
*	*	*	F Anl	Faculty use of microcomputer analytic tools
		*	F CDROM	Faculty use of CD-ROM
		*	F Cls use	Faculty use of computers in the classroom
		*	F Desk	Faculty use of microcomputers for desktop publishing
	*	*	F e-mail	Faculty use of e-mail
	*	*	F LANuse	Actual faculty use of local area networks
		*	F LibDB	Faculty use of on-line library databases
*	*	*	F Lit	Faculty computer literacy
		*	F PresGr	Faculty use of microcomputers for presentation graphics, multimedia
*	*	*	F Prod	Faculty use of microcomputer productivity tools
		*	F UserSup	Computer services support to faculty
		*	F Web	Faculty use of Internet/Web
*	*	*	LAN dev	Development of local area networks
*	*	*	MF Admin	Mini/mainframe use for administrative support
		*	MF Client	Mini/mainframe use as client/server technology
	*	*	MF Comm	Mini/mainframe use as communication server
*	*	*	MF Inst	Mini/mainframe use in instruction
*	*	*	MF Res	Mini/mainframe use in research
*	*	*	Num Lab	Number of microcomputer labs
*	*	*	Num PC	Number of microcomputers
*	*	*	Port	Number of portable microcomputer systems
*	*	*	S Anl	Student use of microcomputer analytic tools
		*	S CDROM	Student use of CD-ROM
		*	S Cls use	Student use of computers in the classroom
		*	S Desk	Student use of microcomputers for desktop publishing
	*	*	S e-mail	Student use of e-mail
	*	*	S LANuse	Actual student use of local area networks
		*	S LibDB	Student use of on-line library databases
*	*	*	S Lit	Student computer literacy
		*	S PresGr	Student use of microcomputers for presentation graphics, multimedia
*	*	*	S Prod	Student use of microcomputer productivity tools
		*	S UserSup	Computer services support to students
		*	S Web	Student use of Internet/Web
	*	*	Strat Pln	Strategic planning process
		*	Sub Port	Number of subnotebook computers
		*	Web cont	Development of Web content
		*	Web dev	Development of Web infrastructure
	*	*	Windows	Windows implementation

## STRATEGIC ISSUES

Admin systems	Administrative systems development
Curr devel	Appropriate curriculum development utilizing computing
Distance	Distance education/learning/teleconferencing
F incentives	Faculty incentives for courseware development/integration
Funding	Adequate funding for operational support
Lack goals	Lack of goals and/or strategic planning
Org structure	Business school's computing services organizational structure
S fees	Student computing fees
Standards	Schoolwide standards for hardware or software
Technology	Keeping current on what technology is appropriate
User expect	Managing user expectations
Web site	Web site development

## INSTRUCTIONAL ISSUES

Amt integr	Defining an appropriate level of "curriculum integration"
CW dev support	Courseware development support
F incentives	Faculty incentives for developing courseware
F style	Teaching style or motivation to use technology
F techchange	Inability of faculty to keep up with technological change
Funding	Lack of funds for curriculum support
PC in cls	Inability to use computers in classrooms

## OPERATIONAL ISSUES

Cls support	AV and networking support for computers in classroom
Consulting	Finding and/or retaining consulting (user-support) staff
F training	Providing adequate faculty training
HW maintenance	Equipment maintenance
Insuff HW	Not enough hardware to meet demand
Insuff space	Sufficient space for computing facilities
Real budget	Creating a realistic budget, identifying the real costs
S training	Providing adequate student training
Staff burnout	Computer staff burn-out/morale
Stf currency	Computer staff training/keeping current
SW licenses	Acquiring software site licenses for school
Tech staff	Finding and/or retaining technical staff
User needs	Matching technology to user needs
Web standards	Establish Web standards
When upgrade	When to upgrade equipment

## NETWORK ISSUES

Access security	Access security/password encryption/firewall
Expansion nodes	Expansion (adding nodes to network)
Laptop con	Laptop connectivity to network
Net in lab	Operating network in lab setting
Net multimedia	Multimedia over network
Net op sys	Which network operating system to adopt
Network software	Software availability for use on a network
NW mgmt	Network management
Reliability	Reliability of network
Remote con	Remote individual connectivity (PPP, SLIP, telnet)
Response time	Response time on network
SW licenses	Software licenses for use on a network