Computer Literacy: Implications for Teaching a College-Level Course

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ABSTRACT

The purpose of this study was to investigate students' perceptions of computer literacy skills they had obtained prior to enrolling in a university and to develop implications and recommendations for teaching a college-level computer course. One hundred twenty-five students who were currently enrolled in a required university computer literacy course completed a questionnaire. Students were asked to identify their skill level in various types of software and their exposure to computer concepts and issues. Results showed that students perceived themselves to be better prepared in word processing than they did in spreadsheet and database applications and that they had not received extensive coverage of ethical, social, legal and global issues. In determining the content of a university computer literacy course, consideration needs to be given to nontraditional students who have not been exposed to computers as well as those students who enter the university with a variety of skill levels. Additionally, an improved and extended coverage of database and spreadsheets might be warranted in a college level computer course. Since required computer literacy competencies are continually changing for high school graduates, it is imperative that universities monitor design and content of the curriculum to provide an adequate computer literacy background for university students.

Keywords: Computer literacy; IS curriculum; information systems

1. INTRODUCTION

Computer capabilities are essential for success in the business world. Technological advances necessitate learning, maintaining, and upgrading of computer-related knowledge. For most, if not all, students, formal education represents a key opportunity to learn and develop computer skills needed for their personal use and professional career. While educational institutions are challenged to provide up-to-date equipment and software packages, educators must also recognize the need to keep abreast of pertinent instructional techniques and trends.

While there is no consensus regarding a precise definition of computer literacy, the topic certainly is quite relevant to key stakeholders: students, educators, and business practitioners (Kim and Keith, 1994; Kretovics and McCambridge, 1998; Wolfe, 1992). Our perspective is that computer literacy involves conceptual knowledge related to basic terminology (including social, ethical, legal, and global issues) and skills necessary to perform tasks in word processing, database, spreadsheets, presentation graphics, and basic operating system functions. As technology and the use of the Internet become increasingly integrated into our personal and business lives, this view acknowledges a need to apply computer skills for problem solving in a variety of circumstances.

Most of today's college students attended high schools during the 1990s, a period in which numerous curriculum changes occurred as computer literacy evolved into an important aspect of education. Even though the extent of computer training might vary among high schools, college students do have perceptions about their prior learning experiences that may assist educators in developing approaches to further enhance curriculum planning and learning strategies.

The purpose of this study was to determine students' perceptions involving the microcomputer skills they

possessed prior to the completion of an introductory college-level computer literacy course. Based on these perceptions, implications and recommendations for teaching college-level computer literacy course were developed. Following development, review, and revision of the questionnaire, it was administered to 125 students enrolled in five sections of an Introduction to Microcomputers course at a Midwestern regional university. Participant questions included inquiries related to identification of learned computer skills, determination of familiarities with different software packages, and their knowledge of concepts and various ethical, social, legal, and global issues. The research process involved analysis of responses, determination of primary highlights, and identification of pertinent conclusions. The chi-square statistical test was used to determine if differences among response categories were significant for comparisons of nominal-scaled variables.

2. AN OVERVIEW OF COMPUTER LITERACY

Rapid technological advances, coupled with greater realities of global competition, increase pressures for businesses to serve customers who have constantly higher quality and performance expectations. Various surveys and focus groups note the need to develop, maintain, and improve computer capabilities (AMA Survey, 1998; Kretovics and McCambridge, 1998; Zhao, 1997). Since educators know the importance of computer literacy, they are concerned about its impact on curriculums (Clinebell and Clinebell, 1995; Marcal and Roberts, 2000; Plutsky and Wilson, 2000).

Some believe that computer literacy has involved preparation of persons to serve as worthy citizens in their communities and understand how society operates in an information age (Burniske, 2001; Costello, 1997). In addition, accreditation associations and governing boards typically include computer literacy standards. For example, AACSB-International has standards related to usage of the library and computers. The Kansas Board of Regents' qualified-admission curriculum for precollege students requires a unit of high school credit in computer technology as one of the options for college entrance. Increased workplace demands for computer literate employees will not likely abate, and today's students will encounter more challenges involving job and career changes in their quest for success. Orrell (1996) speculates that students will change jobs up to 10 times with as many as three career changes.

Fox, Hindi, and Remington (2001) surveyed high school students who were members of Future Business Leaders of America. Slightly more than 94 percent of the respondents had completed at least one computer course but fewer than ten percent had studied a programming language. The most popular content of this course was word processing, spreadsheets, and database. Over a three-year period, Letcher (1998) examined the computer skills of entering college of business students and concluded that they did not have extensive programming experience. However, increasingly larger numbers of students took word processing (from 61.9 percent in 1995 to 77.9 percent in 1997) and spreadsheet (from 44.9 percent in 1995 to 54.2 percent in 1997) packages. In addition, reported usage of the Internet in high-school classes grew from 8.2 percent in 1995 to 35.3 percent by 1997. Greater utilization of the Internet appears to correspond with the trend toward improved computer availability at high schools. In a five-year period (1994-1999), the percentage of secondary schools in the U.S. with Internet access doubled to 98 percent (Doscher, 2000).

The New American High School program provides recognition to secondary schools with rigorous academic standards. A review of schools that were recently named to this list revealed inclusion of such curriculum topics as computer applications, computerized industrial design, and computer repair and maintenance (Dembicki, 1999). Meier (2001) reported results from a computer concepts test given to students enrolled in a computer literacy course at a Midwestern regional university. While slightly over 75 percent of these students scored more than the minimum college entrance acceptable score on word processing, comparable statistics were only 40 percent for database and 63.55 percent for presentation skills. Only 6.13 percent of these students had college entrance scores that exceeded the minimum considered to be acceptable for all components of the test, which also included a wide range of additional topics (networking and the Internet, social and ethical issues, presentation graphics, operating systems/hardware, word processing, database, and spreadsheets).

Universities have been challenged to develop computer literacy content as students make the transition from high school to the workplace. An understanding of previously-acquired computer knowledge and skills enables curriculum designers to develop courses adapted to needs of learners. A study of educational technology at Midwestern business schools located in a thirteen state area showed that all schools required at least one computer literacy course (Berghaus and Wenger, 1997). Giovannini and Poyner (2001) reported survey results that included comparisons of hands-on computer skills used by business to those skills included in the business curriculum at a Midwestern regional liberal arts university. In relation to skills necessary for Windows application software, no

significant differences were found. Internet skills were more highly used in the business school than by business firms. Finally, database entry and validation rules were applied to a greater extent by firms than covered in the business curriculum.

3. RESULTS

Table 1 (Appendix A) presents a frequency distributions for the variables. Most of the respondents (92 percent) were 18 to 22 years old, freshmen (55 percent) or sophomores (21 percent), and lived in the State of Kansas (91percent). Sixty-five percent of participants were males and 35 percent were females. Students graduated from high schools of various sizes. Thirty-four percent of the participants were from high schools larger than 995 students, and 20 percent were from schools having enrollments of less than 137 students. Seventy percent of students reported their high school required a computer literacy course, and 66 percent of these schools used a "hands-on" approach in teaching the course. Students reported that 58 percent of their schools recommended a computer literacy course for college entrance. They perceived that the content of the recommended course for college entrance included word processing (54 percent), spreadsheet (39 percent), concepts (31 percent), database (28 percent), Internet (26 percent), and presentation graphics (17 percent). Such courses were most likely to be offered in the business departments (68 percent) followed by the math departments (6 percent).

High school courses tended to cover computer concepts such as printers (85 percent), the Internet (78 percent), hard drives (70 percent), operating systems (48 percent), virus protection (28 percent), and display units (28 percent). "Softer" issues involving computer usage were not popular in high schools. Students reported coverage of social issues (35 percent), ethical issues (23 percent), legal issues (22 percent), and global issues (14 percent).

The most popular software utilized was Microsoft products. Many individual students were exposed to different versions of the same software package. Office 97 software products were the most frequently used package followed by Office 2000. It might be noted that 34 percent of the students were exposed to Word Perfect products.

The chi-square test was used to determine whether various relations were statistically significant. Tables 2 and 3 (Appendix B) present a summary of calculated values for various chi-squares tests involving computer literacy. Variables included age of students, classification of students, gender of students, location of high school (Kansas vs. other states), size of high school (measured by number of students), and whether the high school required a computer literacy course. Prior research indicates that increasingly larger numbers of students obtained computer literacy skills especially in word processing and spreadsheets. Thus, we used "age of students" and "classification of students" variables to categorize the data. The "location of high school" variable was used due to the fact that the State of Kansas had recently implemented a qualified admission requirement that included computer literacy. The "size of high school" variable was selected because of the perception that larger high schools are expected to have more resources and thus better access to computing facilities. Finally, graduates of high schools that require a computer literacy course were expected to have greater computer competencies than graduates of high schools that do not require such a course. Each of these variables was statistically tested against variables such as skill levels in word processing, database, spreadsheet, and issues such as ethical, social, legal, and global. The remainder of this section discusses results of statistically significant chi-square calculations.

Younger students were more likely to have had their high schools require a computer literacy course and have the course taught using a "hand-on" approach. Also, there was a greater likelihood that their high schools recommended a computer literacy course for college entrance. Therefore, their computer skills were perceived to be adequate (especially in word processing, spreadsheets, and computer concepts) when entering college. Similar results were obtained for freshmen and sophomores. Interestingly, seniors were three to four times more likely to have discussed ethical issues in their computer course in high school than freshmen, sophomores, and juniors.

Next, data were examined that involved gender issues. Males were more than twice as likely to have been introduced to ethical issues in the high school computer course. However, females reported more experience involving create / design database structure, query of database, and "what if" in a spreadsheet than males. On the other hand, males possessed more familiarity with OLE / hyperlinks / subforms in database. Although males and females are assumed to have been introduced to similar contents, it appeared that males had different perceptions of what they learned than females.

Consistent with the State of Kansas qualified admission policy, students from Kansas felt more adequate computer skills entering college, were three times more likely to have their high schools

recommend a computer course for college entrance, were six times more likely to learn word processing, and four times more likely to learn spreadsheets than students from other states. In Kansas high schools, computer courses were offered predominately in the business area (vs. math), and these high schools commonly used word processing for research papers. Kansas high schools were less likely to use spreadsheets for formulas / functions than high schools in other states.

Larger high schools were at least twice more likely to have the Internet as content in their computer literacy course than smaller high schools, which were more apt to use word processing for research papers than larger schools. Smaller and medium size high schools were more likely to use word processing for charts / tables / watermarks and spreadsheet for create spreadsheet / embed charts than larger high schools.

Ninety-six percent of students who reported their high school required a computer literacy course indicated the course was being taught with a "hands-on" approach. Seventy percent of high schools who required a computer literacy course recommended the course for college entrance requirements compared to 30 percent of high schools who did not require a computer literacy course. Eight-nine percent of students whose high schools required a computer literacy course felt they had adequate computer skills when entering college compared to 47 percent of those whose schools did not require such a course. Forty-three percent of students whose schools required a computer literacy course and 16 percent of students whose schools did not require such a course felt their high school computer training sufficiently prepared them to "quiz out" of a college introduction to computer course. Finally, students whose high school required a computer literacy course were twice as likely to have discussed ethical and social issues, three times more likely to have discussed global issues, and six times more likely to have discussed legal issues than those high schools that offered an elective computer course.

4. IMPLICATIONS AND RECOMMENDATIONS

This study surveyed student perceptions of knowledge and skills learned in high school computer courses. Faced with shortages of computer faculty and employer demands for technology-competent graduates, colleges are challenged to attain maximum learning outcomes in introductory computer courses. Consistent with prior research studies, survey respondents indicated that they had studied word processing skills and gained knowledge of computer concepts. However, they noted lesser coverage of database and spreadsheets. Consequently, additional focus on these topics might be recommended for inclusion in introductory college-level computer courses.

Students reported lesser coverage of ethics, social, legal, and global issues in high school computer literacy classes. The importance of this content cannot be overlooked. For example, software piracy and illegal reproduction of software are pertinent marketplace realities. More than 1,400 jobs and $92 million in combined wages, tax revenues, and retail sales were lost in a single state, Kansas, during 1997 because of illegally-copied software. Nationwide, one in five copies of software is used illegally (Seibenmark, 1999). Therefore, this topic is appropriate for discussion in an introductory college-level computer course. Also, adoption of computer-literacy requirements by states, as a component of admission requirements to publically-supported colleges, enhances the likelihood that students will learn needed computer-related competencies.

While freshmen and sophomore students typically learned Microsoft Office 97 in high school, some colleges are considering adoption of Office XP. The importance of software upgrades cannot be neglected by high school curriculum planners. Since younger college students may possess basic skills in word processing, spreadsheets, and computer concepts, college curriculum designers might consider offering a leveling introductory computer course (possibly on a noncredit basis) for nontraditional students who did not have an opportunity to learn basic computer skills in high school. While the literacy level in a version of software will continually be an issue, institutions should consider offering a test-out for students who feel confident with their problem solving skills. The implication of not providing this option may result in insufficient student interest.

While larger high schools were more likely to include Internet coverage as an aspect of computer literacy, smaller schools were more apt to focus on the use of word processing to prepare research papers. Given differences among high-school curriculums and competency levels of graduates, determination of the most appropriate content for introductory computer-literacy courses will continue to be a challenge for colleges.

Although this study was limited from a geographic perspective, it is important that post secondary institutions monitor computer literacy skills of incoming freshman to determine adequate content for university courses. Adjustments must be continually

considered for computer literacy courses by emphasizing those components that represent the weakest skill areas of incoming students. Exhibit 1 summarizes recommendations for teaching a college-level computer literacy course.

Exhibit 1
Recommendations for Teaching a College Level Computer Literacy Course

- ✓ Survey incoming freshman students about their computing skills. The college-level course should address the weak areas in computing. In our survey, students had lesser coverage of database and spreadsheets.
- ✓ College curriculum designers might consider offering a leveling introductory computer course (possibly on a noncredit basis) for nontraditional students who did not have an opportunity to learn basic computer skills in high school.
- ✓ Due to the wide range of computing skills of incoming frehman, it might be very beneficial to offer a "test-out" option for those students with the advanced skills.
- ✓ Avoid duplication of contents in your college-level course. Repeating skills obtained in high school may result in insufficient student interest.
- ✓ To meet specialized business accreditation (such as AACSB-International) as well as address societal concerns about ethical conduct, students should be exposed to ethical, social, legal, and global issues.
- ✓ A college-level computer literacy course should emphasize problem solving skills utilizing technology.
- ✓ Due to high faculty turnover and to assure consistency in teaching college-level computer literacy course, a detailed common syllabus should be developed. The common syllabus should include in detail the amount of time to spend in each topic

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Appendix A

Table 1: Frequency Distribution for Key Variables

Variable	No. Of Resp.	Percent	Variable	No. Of Resp.	Percent
Age of students:			Classification of students:		
18-22	114	92	Freshman	65	55
23-30	7	6	Sophomore	25	21
31-50	3	2	Junior	21	18
			Senior	4	3
Gender of students:			Special	4	3
Male	74	65			
Female	39	35			
Location of high schools:			Did high schools require a		
Kansas	114	91	computer literacy course?	87	70
Other	11	9			
			Is the course taught "hands-on" approach?	81	66
Size of high school (number of students):			Adequate computer skills entering college?		
<137	25	20		95	76
137-232	10	8	If yes, computer training		
233-557	32	26	prepared you to "quiz out"		
558-995	14	11	of college course?		
>995	42	34		43	35
Did high school recommend computer literacy course for college entrance?	72	58	In what area was the high school course offered?		
			Business	85	68
			Math	7	6
If yes, contents of the course:			Not offered	21	17
Word Processing	67	54	Other	18	14
Spreadsheet	48	39			
Data Base	35	28	Student computer skills in		
Presentation Graphics	21	17	presentation graphics:		
Internet	32	26	Create/modify	52	42
Computer Concepts	38	31	OLE	10	8
Other	4	3			
Student computer skills in word processing:			Student computer skills in database:		
Create/print/save doc	118	94	Create/design	62	50
Research papers	112	90	Query	41	33
Wizards/resumes	74	59	Modify/update DB	29	23
Charts/tables/water	65	52	Reports/forms	36	29
Mail merge/labels	53	42	OLE/Hyperlinks	20	16
Newsletter	65	52	Macros	16	13
Student computer skills in spreadsheet:			Student computer-concept skills:		
Create spreadsheet	86	69	Printers	106	85
Formulas/functions	78	62	Hard Drives	87	70
What if/copy, etc.	42	34	Internet	98	78
Financial functions	41	33	Operating systems	60	48
Sort/query database	46	37	Virus protection	35	28
Templates	38	30	Display units	35	28
Students exposure to ethical issues	29	23	Students exposure to social issues	44	35
Students exposure to global issues	18	14	Students exposure to legal issues	28	22

* Percentages may total more than 100 percent due to inclusion of multiple responses.

APPENDIX B

Table 2 : Summary of Calculated Chi-Square Values for Selected Variables

Variable	Age of students Chi Square (Prob)	Classification of students Chi Square (Prob)	Gender of students Chi Square (Prob)	Location of high school Chi Square (Prob)	Size of high school Chi Square (Prob)	Offer comp. Lit. course? Chi Square (Prob)
Require Comp. Lit.	16.8577 (0.0002) ***	18.1384 (0.0012) ***	0.0252 (0.8740)	0.2027 (0.6525)	1.1252 (0.8903)	----------
Hands On	14.5142 (0.0007) ***	13.4092 (0.0094) ***	0.0019 (0.9649)	0.7606 (0.3831)	0.9595 (0.9159)	109.0348 (<0.0001) ***
College Entrance	8.9383 (0.0115) **	11.4187 (0.0222) **	0.0461 (0.8301)	7.8852 (0.0050) ***	5.4511 (0.2441)	17.3881 (<0.0001) ***
Word Processing	7.6564 (0.0217) **	10.4837 (0.0330) **	0.2506 (0.6166)	9.8157 (0.0017) ***	3.2032 (0.5244)	18.7388 (<0.0001) ***
Spreadsheet	4.8876 (0.0868) *	4.5598 (0.3355)	0.2316 (0.6304)	4.4633 (0.0346) **	0.6724 (0.9547)	14.1111 (0.0002) ***
Data Base	4.5515 (0.1027)	0.7529 (0.9447)	0.2103 (0.6465)	2.1816 (0.1397)	1.2276 (0.8735)	10.5353 (0.0012) ***
Presentation Graphics	1.8134 (0.4039)	3.0029 (0.5573)	1.8310 (0.1760)	0.5280 (0.4674)	1.8051 (0.7716)	4.9837 (0.0256) **
Internet	4.6908 (0.0958) *	2.8210 (0.5882)	2.2587 (0.1329)	0.3665 (0.5449)	7.9813 (0.0923)	8.6273 (0.0033) ***
Computer Concepts	4.5055 (0.1051)	8.8622 (0.0646) *	2.1155 (0.1458)	2.6385 (0.1043)	4.3995 (0.3546)	5.1658 (0.0230) **
Adequate Computer Skills Entering College	11.3427 (0.0034) **	10.1201 (0.0385) **	0.0897 (0.7645)	3.0438 (0.0810) *	7.7489 (0.1012)	24.5381 (<0.0001) ***
Could you "Quiz Out" based on skills	3.1707 (0.2049)	5.8643 (0.2095)	2.6445 (0.1039)	1.4500 (0.2285)	2.8186 (0.5886)	7.9344 (0.0049) ***
Microcomputer course offered in Business	4.2002 (0.1224)	15.1777 (0.0043) ***	0.1004 (0.7513)	19.2355 (<0.0001) ***	2.2468 (0.6905)	8.1294 (0.0044) ***
Microcomputer course offered in Math	0.6508 (0.7222)	3.5112 (0.4762)	0.2299 (0.6316)	0.7155 (0.3976)	1.5253 (0.8222)	0.9101 (0.3401)
Ethical	3.3204 (0.1901)	15.2955 (0.0041) ***	3.5835 (0.0584) *	1.3476 (0.2457)	0.9394 (0.9188)	3.0901 (0.0788) *
Social	1.8880 (0.3891)	4.8448 (0.3036)	0.2444 (0.6211)	1.5315 (0.2159)	2.4725 (0.6496)	3.1743 (0.0748) *
Legal	3.1725 (0.2047)	3.8822 (0.4222)	0.4276 (0.5132)	1.2291 (0.2676)	2.9281 (0.5699)	9.2241 (0.0024) ***
Global	0.8776 (0.6448)	6.3957 (0.1715)	0.0054 (0.9414)	0.1399 (0.7083)	4.7811 (0.3105)	3.6977 (0.0545) *

* Significant at 10% level ; ** Significant at 5% level ; *** Significant at 1% level.

Table 3 : Summary of Calculated Chi-Square Values for Selected Variables

Variable	Age of students Chi Square (Prob)	Classification of students Chi Square (Prob)	Gender of students Chi Square (Prob)	Location of high school Chi Square (Prob)	Size of high school Chi Square (Prob)	Offer comp. Lit. course? Chi Square (Prob)
WORD PROCESSING: Research Papers	10.9948 (0.0041) ***	8.4541 (0.0763) *	1.4247 (0.2326)	8.7254 (0.0031) ***	8.3893 (0.0783) *	1.7019 (0.1920)
Charts/tables/watermarks	3.7385 (0.1542)	5.2986 (0.2580)	0.6644 (0.4150)	0.2070 (0.6491)	13.6057 (0.0087) ***	11.6244 (0.0007) ***
Mail merge/labels/envelops	4.6121 (0.0997) *	2.4976 (0.6451)	1.3514 (0.2450)	0.0461 (0.8300)	5.4102 (0.2477)	5.7834 (0.0162) **
DATA BASE: Create/Design Structure	0.5113 (0.7744)	2.1518 (0.7079)	3.9460 (0.0470) **	0.0829 (0.7734)	5.4046 (0.2482)	7.0929 (0.0077) ***
Modify/Update DB Str.	1.0264 (0.5986)	4.8208 (0.3062)	1.4905 (0.2221)	0.1123 (0.7373)	2.2991 (0.6809)	4.9219 (0.0265) **
Macro	0.4629 (0.7934)	2.6561 (0.6169)	0.4712 (0.4925)	0.3130 (0.5759)	1.6996 (0.7908)	1.1770 (0.2780)
SPREADSHEET: Create SP/Embed charts	7.2924 (0.0261) **	6.9058 (0.1410)	0.2981 (0.5851)	3.0624 (0.0801) *	8.6634 (0.0701) *	6.6492 (0.0099) ***
Formulas/Functions	6.3997 (0.0408) **	10.4241 (0.0339) **	1.0516 (0.3051)	3.4849 (0.0619) *	1.5041 (0.8259)	22.1053 (<0.0001) ***
What if/Copy, etc.	2.8081 (0.2456)	9.3990 (0.0519) *	3.4463 (0.0634) *	1.2852 (0.2569)	3.9866 (0.4078)	13.0287 (0.0003) ***
Financial functions	5.1796 (0.0750) *	6.3459 (0.1748)	1.3641 (0.2428)	1.1693 (0.2795)	5.4343 (0.2456)	12.2890 (0.0005) ***
Sort/query data base	1.9899 (0.3697)	9.1061 (0.0585) *	1.6714 (0.1961)	0.0010 (0.9749)	4.2912 (0.3680)	7.9296 (0.0049) ***
Templates	1.8426 (0.3980)	1.7923 (0.7739)	0.6754 (0.4112)	0.2027 (0.6525)	4.2442 (0.3740)	5.5084 (0.0189) **
CONCEPTS: Printers	7.3769 (0.0250) **	5.7041 (0.2224)	1.0681 (0.3014)	1.3639 (0.2429)	2.2868 (0.6832)	3.0490 (0.0808) *
Hard Drives	7.7070 (0.0212) **	1.3634 (0.8505)	0.0012 (0.9728)	1.2920 (0.2557)	2.5648 (0.6331)	3.5355 (0.0601) *
Operating Systems	6.7652 (0.0340) **	2.1976 (0.6995)	0.8485 (0.3570)	0.2070 (0.6491)	2.8865 (0.5770)	1.5902 (0.2073)
Display Units	1.2095 (0.5462)	3.5759 (0.4664)	0.2103 (0.6465)	0.0032 (0.9551)	4.7792 (0.3107)	4.0379 (0.0445) **

* Significant at 10% level ; ** Significant at 5% level ; *** Significant at 1% level.

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