

TEACHERS' PERCEPTIONS OF FACTORS AFFECTING THE INFORMATION TECHNOLOGY WORKFORCE IN MISSISSIPPI

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Abstract

The purpose of this study was to ascertain agriculture and non-agriculture teachers' perceptions of the factors affecting Mississippi's Information Technology Workforce (ITW). A three-round, modified Delphi procedure was used to collect the perceptions of 24 agricultural science and business/biology teachers regarding factors affecting the information technology workforce. Twenty-one teachers completed all three rounds of this study. After an initial set of 45 factors was generated, participants strongly agreed that 11 of the factors are very important factors affecting Mississippi's information technology workforce. Most of the factors dealt with either training or equipment issues. The factors identified by teachers are congruent with findings from the Mississippi Department of Education (2000) and the Mississippi Economic Council (2000). Recommendations include placing more emphasis on information technology concepts into preservice and inservice programs, obtaining and maintaining information technologies comparable to that used in industry, and forging relationships with business and industry to provide on-the-job training opportunities for individuals pursuing information technology careers.

Introduction

Information Technology (IT) is a concept describing all aspects of managing and processing information. Most IT careers now and in the future are based on computer technologies, the Internet, and networks that tie it all together. Information tools, such as personal computers and the Internet, are increasingly critical to economic success and personal advancement. However, a widening technological gap in America currently exists. This significant digital divide separating American information 'haves' and 'have nots' will further segregate America's IT workforce.

The persons with the least likely access to technology, and by default, lesser opportunities for economic well being, are low-income blacks or Hispanics in rural communities. In Mississippi, this is an alarming

fact since one in four Mississippians lives at or below the poverty level and is rural-based, and nearly one in three children lives at or below the poverty level (US Census Bureau, 1998). Yet, Mississippi has the research, industry base, and public/private institutions to support information technology clusters (Mississippi Economic Council, 2000). Jackson, Mississippi, the state capital, has been recognized as a telecommunications hub for not only the state, but also the world (Doty, 2000). Because these building blocks are present, Mississippi can enhance the productivity of traditional industries and move towards a competitive advantage within the region (Mississippi Economic Council, 2000). Such gains would be more attractive at the national level and could entice information technology businesses to locate in Mississippi, especially in rural areas.

If Mississippi is to develop a competitive advantage in relation to IT, public school systems must educate and train students about information technologies. The Governor's Task Force for Classroom Technology (Office of the Governor, 2001) established as its goal to have an Internet-accessible computer in every public classroom by the end of 2002. By achieving this goal, the educational experiences of Mississippi students will be enhanced and the digital divide in Mississippi will be bridged.

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Conceptual Framework

Mississippi faces a number of challenges to become savvy in information technologies. Public school systems are not producing IT-ready students for the workforce. Students also cannot receive IT training at community colleges because the proper resources are not available. Currently, inefficiencies exist in the labor market, resulting in an unsatisfactory demand and students not being linked to potential information technology job opportunities. Even if individuals were to become employed in IT jobs in Mississippi, the salaries they would receive would be considerably lower than IT jobs in other regions (Mississippi Economic Council, 2000).

Being a rural state, few IT businesses exist within Mississippi's rural communities. As educational institutions train students for IT careers, few, if any, opportunities exist to have adequate on-the-job training. Thus, proper training programs cannot be developed to prepare individuals for IT careers. Likewise, inadequate salaries and a poorer quality of life make it difficult to attract quality instructors to these rural areas to train prospective and current workers for information technology careers (Mississippi Economic Council, 2000).

Certain needs must be addressed if educational institutions are to prepare a literate information technology workforce. The most critical needs are in the areas of

software/hardware acquisition, training, and facility upgrades (Mississippi Department of Education, 2000; Kotrlik, Redmann, Harrison, & Handley, 2000). Training is a big concern when it comes to preparing individuals for information technology careers. Without properly trained individuals, the technological infrastructure is of little value (Mississippi Department of Education, 2000). Mississippi must commit to providing relevant and up-to-date training at all levels if the IT workforce is to succeed.

Teacher training and continuing education need to be provided to teachers for them to know how to operate and integrate appropriate information technologies into the curriculum (Kosakowski, 1998). The U.S. Congress's Office of Technology Assessment reported that only 64% of teachers had received any type of training in distance learning technologies (Mississippi Department of Education, 2000). Furthermore, 75% of teachers who were interviewed indicated the greatest service need was for initial and advanced training in information technologies.

How adequate are Mississippi's classrooms and teachers in preparing future workers for information technology careers? While over 80% of Mississippi's public school classrooms have a TV/VCR, less than 10% of public school classrooms are wired for data. Also, less than 10% of the classrooms have access to a multimedia distribution center and 15% only had ways for parents to communicate electronically with the school (Mississippi Department of Education, 2000). Teachers felt completely comfortable using TVs and VCRs in the classroom but were less comfortable using CD-ROMs, satellite learning, telecommunications, and integrated learning systems as a means of classroom instruction.

The Office of Technology Policy (OTP, 1999) found other factors affecting the supply and quality of IT workers. These included a poor image of the IT profession, lack of career information and encouragement for students, a need for increased competency in math and science, challenges in the IT teaching infrastructure, and a failure to attract underrepresented groups to the IT profession. The OTP report encouraged educators to provide K-12 students, especially middle school

students, with information on science and technology careers, their rewards, and what education and training are necessary to pursue them (Meares & Sargent, 1999). At the heart of this encouragement should be a basic understanding of IT and its connection to using computers in the workplace. Mississippi's Agricultural and Environmental Science and Technology (AEST) programs—a computer skills and IT based curricula—are fostering students' IT career path decisions as it relates to using information and computer technologies for today's food and fiber production. At the core of this issue is determining the IT perspectives from many groups charged with the education of Mississippi's youth.

Future IT users must be computer literate. IT users must be able to interpret information that technology makes available, understand IT concepts, and be lifelong learners of IT, which is much more than earning a degree in computer science. Researchers must understand that the United States and the world will always have more IT users than workers; it is time to determine the factors associated with IT use, to better understand how to influence the factors affecting the IT Workforce.

If the United States is to remain competitive in the world marketplace, the foundation of information technology knowledge and skills is a necessity of the U.S. is to have a well-trained workforce (Kotrlík, et. al., 2000). For Mississippi to focus on information technology careers and move towards a competitive advantage, potential factors affecting the future IT workforce need to be identified and addressed. What are the factors associated with the decision to enter an IT career path? Who influences this decision? What do agriculture and non-agriculture teachers think are the factors affecting Mississippi's Information Technology Workforce?

Purpose and Objectives

The purpose of this study was to ascertain agriculture and non-agriculture teachers' perceptions of the factors affecting Mississippi's Information Technology Workforce (ITW). The objectives guiding this study were:

1. Identify factors affecting Mississippi's ITW.
2. Rate the importance of each factor in addressing Mississippi's ITW.
3. Rate the level of agreement for each factor in addressing Mississippi's ITW.

Procedures

The population for the study consisted of 24 secondary Agricultural Science and Business/Biology teachers attending the initial research workshop for the National Science Foundation project "Changing Perceptions: Agriculture, Education and Information Technology in Mississippi." The population included 13 Agricultural science teachers and 11 Business/Biology teachers, with a gender ratio of 15 males and 9 females who represented all geographical areas in the state. Teaching experience ranged from 1 to over 25 years.

A modified Delphi procedure was selected for this study because it is a tool that is useful in generating a consensus about a current problem, while anticipating future problems and related needs (King, 2000). The Delphi procedure develops consensus in a series of rounds. The initial stage solicits open-ended comments from the panel of experts, which are returned anonymously then reformatted by the researchers into opinion statements placed on an instrument and returned to the panel for round two. Round two responses are synthesized and refined into the instrument to be used in additional rounds to reach consensus (Lang, 1998). The technique can be used to reach consensus, formally or informally, with large and small groups and avoids the conflicts that may develop in face-to-face confrontations (Cline, 2000)

The first Delphi round was conducted as a pre-workshop item before any topics related to Information Technology were discussed, thus preventing researchers' biases in the population's responses. The participants were asked to list the three most important factors facing Mississippians in relation to the Information Technology Workforce. Researchers reviewed the responses, excluded duplicate responses, and generated 45 statements for rating purposes in the second round. The second round of the modified Delphi was

conducted as a post-workshop activity, along with the workshop evaluation. Participants rated the 45 statements as (1) Not Important, (2) Somewhat Important, (3) Important or (4) Very Important in addressing Mississippi's Information Technology Workforce Issues.

In conducting the third Delphi round, a total of 18 statements were considered for the final instrument since they were rated as very important ($M = 3.50-4.0$) in round two. In reviewing these statements, some statements were combined because participants rated statements with very similar content equally important. Therefore, the third round of the Delphi consisted of 16 factors from round two to which the respondents indicated their level of agreement from (1) Strongly Disagree, (2) Disagree, (3) Agree and (4) Strongly Agree. The participants were sent an email message with the Internet location of the round three Delphi instrument and asked to respond online within 24 hours. (Three participants did not have email address, but did have Internet access and were faxed the information and were asked to respond online.) Respondents were asked to email the researcher that they had completed the instrument so non-respondents could be followed-up with an additional email messages. The final Delphi round had 21 respondents for an 87.5% response rate (two teachers transferred between programs and one teacher retired between the second and third rounds of the Delphi).

Findings

As a pre-workshop activity, the 24 Mississippi Agricultural Science and Business/Biology teachers identified what they perceived to be the top three factors affecting Mississippi's Information Technology Workforce. It was important for teachers to identify and record their perceptions of these

factors prior to learning additional definitions of information technology careers and the researcher team's perceived beliefs of information technology. As a group, the teachers identified over 60 factors, which resulted in a finalized list of 45 factors once duplicate items were deleted. The research team recorded teachers' perceived factors verbatim and prepared the list of factors for individual ratings of the importance each factor held in addressing Mississippi's ITW.

Near the completion of the initial Mississippi ITW research workshop, each teacher was allowed as much time as needed to rate the level of importance (1=Not Important, 2=Somewhat Important, 3=Important or 4=Very Important) for each of the 45 factors identified from the first Delphi round. Item means of Agricultural Science and Business/Biology teachers' perceived level of importance for each of the factors affecting Mississippi's information technology workforce are presented in Table 1, ranked in order of importance.

Teachers participating in the first and second rounds of this Delphi study identified and rated 18 of the items affecting Mississippi's Information Technology Workforce with a mean score of 3.5 or higher. Of these 18 items, educating the future workforce to be resourceful in the use of technology received the highest rating ($M = 3.92$) while two items, communication with industry about their ITW needs and training opportunities for all students in all schools ($M = 3.50$), were the lowest rated items of these 18 statements. Ten of the 18 items were training related while 4 items were related to equipment. The remaining four items that were rated with a mean score of 3.50 or higher were concerned student perceptions of technology; the state's ability to attract technology businesses; cooperation among students, parents, and schools; and communication with industry about their needs.

Table 1. Agricultural science and business/biology teachers' perceived level of importance of the factors affecting Mississippi's Information Technology Workforce

Information Technology Workforce Factors	Total	Agri.	Bus./Bio
	N=24	N=13	N=11
	M	M	M
Educating future workforce to be resourceful in the use of technology.	3.92	3.92	3.91
Keeping information and equipment updated.	3.83	3.85	3.82
Availability/access to computers in schools—for student use—one (computer) per classroom is not enough.	3.79	3.77	3.82
Access to computers, Internet in schools for student use.	3.75	3.69	3.82
Teacher training in technology.	3.70	3.92	3.45
Ability to adopt/adapt technology with academic courses.	3.67	3.62	3.73
Educating current workforce so people can adapt to changes occurring in their jobs.	3.67	3.77	3.55
Keeping teaching strategies and information compatible with industry.	3.67	3.85	3.45
How students view technology—what it is—how it will help them?	3.67	3.54	3.82
Students' ability to comprehend what they have read.	3.63	3.77	3.45
Availability of effective computer classes in schools.	3.63	3.46	3.82
Time needed for gaining information technology knowledge.	3.63	3.85	3.36
Lack of technology training so people can be productive in the workforce.	3.57	3.62	3.50
Attracting technology business to locate in Mississippi.	3.55	3.75	3.30
Technology (how to use technology) in the workplace.	3.54	3.46	3.64
Involvement with students, parents and schools-working together.	3.52	3.67	3.36
Communication with industry about their needs (ITW).	3.50	3.38	3.64

Scale: 1 = Not Important, 2 = Somewhat Important, 3 = Important, 4 = Very Important

(table continues)

Table 1. (continued)

	Total N=24	Agri. N=13	Bus./Bio. N=11
Information Technology Workforce Factors	M	M	M
Training opportunities for all students in all schools.	3.50	3.62	3.36
Lack of computers or new technologies.	3.46	3.62	3.27
All industries, including agriculture, require people to interact with high tech, and many Mississippians do not receive any training that allows them to compete in the local workforce.	3.42	3.38	3.45
Computer literacy.	3.42	3.54	3.27
Funding in some parts of the state have delayed getting computers in classes for students.	3.42	3.38	3.45
Involvement with parents.	3.42	3.54	3.27
Money to upgrade existing technology labs.	3.42	3.38	3.45
Training students for new jobs.	3.42	3.46	3.36
We (students) are not able to apply what they have learned.	3.38	3.46	3.27
Interest in new subject matter (ITW).	3.35	3.38	3.30
Preparing people for new ideas.	3.33	3.23	3.45
Various computer programs.	3.33	3.38	3.27
Work habits.	3.33	3.62	3.00
Learning more about what students are being taught.	3.29	3.38	3.18
Responsibility for workforce technology training.	3.25	3.31	3.18
Changing attitudes of older Mississippians toward new technologies.	3.17	3.23	3.09
Computers used in the home.	3.13	3.15	3.09
Many technology areas require specific training and knowledge.	3.13	3.23	3.00

Scale: 1 = Not Important, 2 = Somewhat Important, 3 = Important, 4 = Very Important

(table continues)

Table 1. (continued)

Information Technology Workforce Factors	Total	Agri.	Bus./Bio
	N=24	N=13	N=11
	M	M	M
Need for more instructors.	3.08	3.08	3.09
Motivation to learn/absorb subject matter in ITW.	3.00	3.15	2.82
Overcoming negative attitudes-“I can’t,” “They just mess up all the time,” etc.	3.00	3.15	2.82
Curriculum not developed to teach technology-based courses.	2.96	3.00	2.91
Most people count on television as their only source of information.	2.88	2.92	2.82
Fear of change.	2.83	2.77	2.91
Computer use by Mississippi adults is behind their children.	2.82	2.82	2.82
All schools are not participating (in ITW).	2.79	2.46	3.18
Myth: technology is a complicated area that requires expansive knowledge and study.	2.54	2.31	2.82

Scale: 1 = Not Important, 2 = Somewhat Important, 3 = Important, 4 = Very Important.

For Round 3, the research team included those factors receiving a rating of 3.50 or higher from round two. Although 18 items had mean scores of 3.50 or higher, two pairs of items were combined because of their likeness. This yielded a round three instrument with 16 items. All 24 teachers were asked to rate their level of agreement for each of the 16 items through an online interactive survey form. Item means for Agricultural Science and Business/Biology teachers’ level of agreement for each of the factors affecting Mississippi’s information technology workforce are reported in Table 2.

In the third and final round of this modified Delphi study, 21 Agricultural Science

and Business/Biology teachers strongly agreed with 11 of the 16 factors affecting Mississippi’s Information Technology Workforce. Training opportunities for all students, educating the current and future workforce about technological changes and computer access issues were rated as the factors most affecting Mississippi’s current and future information technology workforce. Teachers participating in this round of the Delphi were not as strong in their agreement with the factors of availability of effective computer classes in schools or the lack of technology training so people can be productive in the workforce.

Table 2. Agricultural science and business/biology teachers' agreement levels on factors affecting Mississippi's information technology workforce

	<u>Total</u> N=21	<u>Agri.</u> N=10	<u>Bus./Bio.</u> N=11
Information Technology Workforce Factors	M	M	M
Training opportunities for all students in all schools.	3.90	3.90	3.91
Educating current workforce so people can adapt to changes occurring in their jobs.	3.76	3.70	3.82
Educating future workforce to be resourceful in the use of technology.	3.71	3.80	3.64
Access to computers/Internet in schools for student use.	3.71	3.80	3.64
Keeping teaching strategies and information compatible with industry.	3.71	3.80	3.64
Teacher training in technology.	3.67	3.60	3.73
How students view technology—what it is—how it will help them?	3.67	3.50	3.82
Involvement with students, parents and schools-working together.	3.67	3.60	3.73
Attracting technology businesses to locate in Mississippi.	3.62	3.40	3.82
Keeping information and equipment updated.	3.52	3.50	3.55
Ability to adopt/adapt technology with academic courses.	3.52	3.50	3.55
Students' ability to comprehend what they have read.	3.48	3.20	3.73
Time needed for gaining information technology knowledge.	3.48	3.50	3.45
Communication with industry about their needs (ITW).	3.43	3.40	3.45
Lack of technology training so people can be productive in the workforce.	3.38	3.40	3.36
Availability of effective computer classes in schools.	2.95	3.22	2.73

Scale: 1.0 - 1.50 = Strongly Disagree, 1.51 - 2.50 = Disagree, 2.51 - 3.50 = Agree, 3.51 - 4.0 = Strongly Agree.

Conclusions and recommendations

Agricultural science and business/biology teachers participating in this study believe that there are important factors affecting the ITW workforce in Mississippi. The majority of these factors are training related. Both teacher and student training appeared to be important factors affecting Mississippi's Information Technology Workforce. Teachers responding to this study also believe that important factors relating to having access to current equipment/technology contribute to Mississippi's Information Technology Workforce. These conclusions support statements made by the Mississippi Department of Education (2000) and Kotrlik, et. al (2000) regarding the need for on-going training for individuals seeking careers in the IT workforce. Congruent with a 2000 report by 21st Century Workforce Commission that the lack of IT businesses provides little opportunity for on-the-job training, it can also be concluded from the findings in the present study that the state's inability to attract businesses with IT careers has had negative effects on individuals IT training.

It is recommended that Mississippi educational public and private institutions place more importance on information technology in preservice and inservice teacher preparation programs. It is also suggested that Mississippi educators, from Kindergarten through the university level, look for more opportunities to infuse information technology subject matter and use into their instruction. Plans need to be made by educational institutions for obtaining and maintaining information technology comparable to that used in industry. This technology needs to be made available in sufficient quantities to insure availability to all students. Educational institutions need to forge relationships with IT businesses to establish on-the-job training opportunities for their students and graduates.

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