

**ATTITUDES OF SECONDARY AGRICULTURAL SCIENCE
AND BIOLOGY/BUSINESS STUDENTS TOWARD INFORMATION
TECHNOLOGY: A LONGITUDINAL TREND STUDY**

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Abstract

The purpose of this study was to determine the attitudes of secondary students enrolled in Agricultural and Environmental Science and Technology (AEST) programs and biology/business programs in Mississippi toward information technology over a three year period (2002-2004) after completion of their respective high school courses. The population for the study was secondary students enrolled in 14 Agricultural and Environmental Science and Technology (AEST) programs and 14 Biology/Business programs from all geographical areas of Mississippi. Students indicate their level of agreement to 23 statements regarding their attitudes towards information technology. Each year, students had favorable attitudes toward information technologies. Information technology careers are exciting for everyone, including females and minorities. One does not need strong math skills or computer programming skills to be engaged in an IT career. Actively learning through the use of information technologies can help improve communication skills and develop marketable job skills. However, student more recently completing agriculture and biology/business courses tend to agree more that information technology careers are boring and are less exciting to pursue, yet more strongly agreed that females should pursue information technology jobs. Teachers guiding AEST programs must be adequately prepared and skilled in the use of information technologies if such programs are to be successful. Appropriate professional development opportunities should be provided to AEST teachers to keep them abreast of information technologies and their applications to agriculture. AEST programs should also develop career awareness opportunities for their students to promote information technology careers in agriculture.

Note: This paper is based upon work supported by the National Science Foundation Information Technology Workforce Project, Project # 0089970. applications range from record keeping, to making management decisions about fertilizer and pesticide applications, to determining livestock breeding programs, to using Global Positioning Systems (GPS) and Global Information Systems (GIS).

Introduction

Information Technology (IT) describes all aspects of managing and processing information. IT careers are based on computer technologies, the Internet, and networks concerned with creating, analyzing and accessing data for decision-making and problem solving. Information tools, such as personal computers and the Internet, are increasingly critical to economic success and personal advancement. The IT workforce is not just computer engineers and programmers, but individuals with a high skill level in information technologies. These careers require computer fluency - being able to interpret the information that technology makes available, understanding design concepts, and being a lifelong learner of technology that covers a wide range of subjects and careers other than computer science. Many IT workers design, develop, support and/or manage the IT systems found in careers related to agriculture. These

Individuals least likely access to technology are minorities living in rural communities. In Mississippi, 25% of the citizens live at or below the poverty level and nearly one in three children lives at or below the poverty level (US Census Bureau, 1998). However, the state has the research and IT industry base, and public/private institutions to support information technology clusters (Mississippi Economic Council, 2000). Jackson, the state capital, has been recognized as a telecommunications hub for not only the state, but also the world (Doty, 2000). As a result, Mississippi can enhance the productivity of traditional industries and move toward a more 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 rural areas of Mississippi. However, if Mississippi is to develop a competitive advantage in relation to information technology, public school systems must educate and prepare students about information technologies.

Mississippi has a diverse and vitally agriculture industry making it a “major player” on the national and international scene. This fact, along with Mississippi’s information technology research and industry base, provided the impetus for the State Department of Education to transform traditional “agriculture programs” into contemporary Agricultural and Environmental Science and Technology (AEST) programs with the latest agricultural science knowledge base and technological advancements during the late 1990s.

AEST introduces students to new technologies and instructional areas leading to careers in related industries. The curriculum is designed to start students with a broad knowledge base in agricultural production, food processing, plant genetics, environmental stewardship, and international trade. Subject matter areas are supported by a variety of information technologies required for accessing and analyzing information and solving problems. Emphasis is on an active learning environment enriched with technology and science based applications. The course serves as the entry-level course for the other courses in the AEST curriculum. The course consists of 13 units taught using computer modules and related activities. Students use the computers for obtaining instructional content, journaling, accessing World Wide Web sources, and submitting

unit evaluations. Computers are used daily as an integral component of the instructional program. Each unit explores current and emerging trends, technologies, and career opportunities associated with that unit. These programs are located in all areas of Mississippi, urban and rural, and have a significant percentage of females and minority students enrolled.

From an educational standpoint, information technologies have an effect on how people learn, what people know, and where people obtain knowledge and information (National Science Foundation, 2000). IT influences the creation of scientifically derived knowledge, how children learn in school, lifelong learning by adults, and the storage of a society's cumulative knowledge. IT can bring new information and types of instruction into the classroom, it can provide students with new tools for finding and manipulating information, and it can provide resources that are not available in a particular geographical area. All of this is dependent on the attitude individuals have toward information technologies and their impact on society.

Theoretical Framework

In the innovation-decision process individuals pass through a series of five stages when deciding whether or not to adopt a new product or innovation (Rogers, 1995). In the second stage individuals are to form an attitude toward the innovation. Fishbein and Ajzen (1975) refer to an attitude as a learned predisposition to respond in a consistently favorable or unfavorable manner with respect to a given object. An individual should already have knowledge and exposure to the innovation's existence. From that stage, individuals must be persuaded to form either a favorable or unfavorable attitude toward the innovation. In developing this attitude, individuals may mentally apply the new idea to their present or future situation before deciding whether or not to accept the innovation (Rogers, 1995). In this vicarious situation, individuals must think hypothetically and project the future to assist them with forward planning regarding the innovation. While the innovation may have a degree of uncertainty, individuals seeking to adopt a new innovation will want to know that their thinking is on the right track in comparison to their peers.

The main outcome should be the adoption or rejection of the innovation as long it is consistent with the attitude held (Rogers, 1995). This may not always be the case. While the formation of a favorable or unfavorable attitude may not lead to adoption or rejection respectively, the tendency is for attitudes and actions to become more consistent over time. Attitudes may also not be converted into action because communication channels used to help adopters make their decision are not utilized effectively.

Though the literature is void with respect of attitudes towards information technologies, numerous studies report attitudes towards computers and technology careers, which are a vital component of the information technology picture. Having an understanding of students' knowledge and attitudes are necessary and prerequisite to effective teaching about technology (Bame, Dugger, deVries, & McBee, 1993).

However, it may be difficult for students to express their attitude towards technology because they may have neither an accurate nor a complete knowledge of such technology.

Secondary school students have mixed attitudes towards certain aspects of information technology. Houtz and Gupta (2001) found that 38 % of Nebraska high school students had little or no interest in pursuing an information technology career. Sixty two percent had at least some interest in an IT career although only 9 % indicated they were very interested. In a study by Bame, Dugger, deVries, and McBee (1993), 60 % of males thought they would chose a technological profession while 66 % of females said they would not seek a technological career.

Males are more interested in pursuing an IT or technology career than their female peers (Houtz & Gupta, 2001; Ratt & deVries, 1985) even though girls believe that technological fields are appropriate for both genders (Ratt & deVries, 1985). Furthermore, males also felt more confident in their ability to acquire the necessary technology skills (Houtz & Gupta, 2001). Brunner and Bennett (1987) and Ratt and deVries (1985) found that young women often feel they are not suited for technological careers because they are not whole-heartedly “for” technology.

Canada and Brusca (1991) discovered males expressed more interest in computers, less anxiety about mastering computers, a stronger belief that computer skills lead to respect from parents and peers, and a stronger belief that women cannot be as skilled with computers as men. Females with computer programming experience expressed similar levels of computer interest, self-confidence, and beliefs in gaining respect from computer mastery. Females also disagreed with the belief that women cannot be as skilled with computers as men. Attitudinal differences disappeared when both males and females had at least one class in computer programming.

Students who have enrolled in technology education programs and encountered a positive educational experience have developed favorable attitudes toward technology and the pursuit of technological careers (Ratt & deVries, 1985). Such results did occur in the Bosser, Palmer, and Daugherty (1998) for students who enrolled in a nine-week technology education course. It is hoped that AEST programs can have the same impact on the students who enroll in such courses to prepare individuals with the knowledge and skills to pursue careers in the information technology workforce.

In agricultural education, the literature is void of studies about the use and attitudes of computers by high school students. Numerous studies exist examining uses skills needed by and attitudes of computers at university settings by college students and faculty members or by secondary agriculture teachers. Monk, Davis, Peasley, Hillman, and Yarbrough (1996) recommended in their report that university students should be comfortable with computer and information technologies so they can develop new computer skills throughout their careers, implying computer skills and information technology skills are directly related to career success. A study by Kotrlik, Redmann, Harrison, and Handley (2000) focused on information technology professional development opportunities of Louisiana agriscience teachers and found that while teachers value information technology, they places less reliance on information

technology training offered in university settings. Furthermore, these teachers, while having computers in their classrooms, really do not have all of the latest information technologies available, especially multimedia devices and electronic mail.

Purpose and Objectives

The purpose of this study was to determine the attitudes of secondary students enrolled in Agricultural and Environmental Science and Technology (AEST) programs and biology/business programs in Mississippi toward information technology over a three year period (2002-2004) after completing high school agriculture, biology, or business courses. The data were examined to identify trends which may have developed in the population of high school students enrolled in AEST programs and biology/business programs regarding their attitudes towards information technology.

Methods and Procedures

This study was conducted as a longitudinal trend study (Creswell, 2002; Gay & Airasian, 2003; Borg & Gall, 1989). According to Borg and Gall (1989), "In trend studies, a given general population is sampled at each data collection point. The same individuals are not surveyed, but each sample represents the same population" (p. 422).

The population for this study consisted of students enrolled in either one of the 14 Agricultural and Environmental Science and Technology (AEST) programs or one of the 14 Biology/Business programs selected to be included in the study. Programs selected represented all geographical areas in Mississippi. A census of all students from these 28 programs was used in the study each academic year. Schools were matched based on demographics, such as school size, ethnic makeup, and school programs.

The researchers developed the instruments used in the study. Before the first year of data collection, twenty-four teacher consultants attended a workshop to develop the instruments to be used in the data collection process. After conducting a session on survey instrument development, university staff shared with teacher consultants the project objectives and sample questionnaires developed from a review of literature. Teacher consultants added and/or deleted items, recommended age-group appropriate wording, and revised the format of the instruments. Teacher consultants also recommended procedures for data collection and suggested consideration be given to placing the survey instruments on-line to expedite data collection as well as save money on printing instruments and postage. Since they would assist in data collection process, teacher consultants participated in Institutional Review Board (IRB) Human Subjects Research Training. Following each year of data collection, the instruments were reviewed and revised by the teacher consultants.

The part of the questionnaire used to collect data on students' attitudes toward information technology consisted of 23 statements. Students rated the 23 statements on a Likert-type scale (1 = *strongly disagree*; 2 = *disagree*; 3 = *agree*; 4 = *strongly agree*) to identify their attitude towards information technology. University staff finalized the instruments and placed them on the web for teacher consultants to review and provide

additional feedback before pilot testing. After receiving feedback the instruments were pilot tested using state officer candidates attending the state FFA convention and re-administered at the state leadership conference. A test-retest reliability coefficient measuring .59 for this section of the instrument was calculated. Even though the reliability coefficient was low, such reliability coefficients are acceptable according to the recommendations by Nunnally and Bernstein (1994) for instruments that are developed and used for the first time.

This part of the questionnaire was slightly modified in spring 2002 to delete one statement and break another statement into two separate statements. The modified instrument was used during the second and third years of data collection and the data is presented accordingly in this paper.

Each year the instruments were then printed and mailed to teachers or also placed on the web for the data collection. Each year teacher consultants were supplied with parental consent and student assent forms. During years one and two of the study, 17 of the 28 teachers had their students complete the instruments online with the remaining teachers having their students complete paper instruments. During year three, all schools completed traditional paper instrument. AEST teachers surveyed students enrolled in the Concepts of Agriscience Technology courses and business and biology teachers surveyed introductory classes primarily made up of 9th and 10th graders. Since the instruments were administered to students on a specific day(s) designated by the researchers, only those students who were in class on those days completed the instruments. No follow-up measures were used to collect data from those students who were absent, so results cannot be generalized to all high school students enrolled in AEST and biology/business programs in this state.

Data were summarized using descriptive statistics. Frequencies, percentages, means, and standard deviations were used to describe demographic characteristics and attitudes towards information technology.

Findings

Results and findings in this paper are based on the responses provided by students who were in class on days the instruments were administered. During year one of the project, usable responses were provided by 762 students. Fifty two percent of those who responded in spring 2002 were male while 48% were female. The majority were 9th graders (53%) and 32% were 10th graders. Another 10% were in the 11th grade with only 5% in the 12th grade. Caucasians comprised 55% of the participants while African Americans comprised 42%. Hispanic Americans, Asian Americans, and individuals reporting to be of mixed ethnicity comprised the remaining 3%.

During year two of the project, usable responses were provided by 932 students. Fifty two percent of those who responded in spring 2003 were male while 48% were female. The majority were 9th graders (59%) and 28% were 10th graders. Another 10% were in the 11th grade with only 3% in the 12th grade. Caucasians comprised 52% of the participants while African Americans comprised 43%. Hispanic Americans, Asian

Americans, and individuals reporting to be of mixed ethnicity comprised the remaining 5%.

During year three of the project, usable responses were provided by 756 students. Fifty six percent of those who responded in spring 2004 were male while 44% were female. The majority were 9th graders (51%) and 32% were 10th graders. Another 11% were in the 11th grade with only 6% in the 12th grade. Caucasians comprised 62% of the participants while African Americans comprised 32%. Hispanic Americans, Asian Americans, and individuals reporting to be of mixed ethnicity comprised the remaining 6%.

Attitudes Towards Information Technology

Respondents indicated how much they agreed or disagreed with a list of 23 Likert-type statements (1 = *strongly disagree*; 2 = *disagree*; 3 = *agree*; 4 = *strongly agree*) regarding their attitudes toward information technology. Their responses are presented in Table 1. The highest rated statement in spring 2002 was “My information technology skills are adequate for me to complete my schoolwork” ($M = 3.06$) followed by “E-mail programs are important as a means of communication” ($M = 3.02$), “My parents think computers and information technologies are important subjects to learn” ($M = 2.99$), and “Completing my schoolwork with information technologies is easier than using paper and pencil” ($M = 2.98$). The lowest rated statements in spring 2002 were “I think information technology careers are just for males” ($M = 1.48$),

Table 1

High School Students' Attitudes Toward Information Technology

Statements Regarding Information Technology	Year		
	Sp 2002 <i>f</i> = 762	Sp 2003 <i>f</i> = 932	Sp 2004 <i>f</i> = 756
My information technology skills are adequate for me to complete my schoolwork.	3.06	3.04	2.98
I think information technology careers are just for males.	1.48	1.56	1.62
Completing my schoolwork with information technologies is easier than using paper and pencil.	2.98	2.91	2.84
Ethnic minorities could be very successful in an information technology career.	2.82	2.87	2.74
My community depends on information technology to conduct business daily.	2.81	2.80	2.71
I received enough instruction about the Internet before completing class assignments.	2.80	2.84	2.68
An information technology career means working only with a computer.	2.11	2.06	2.10
If more people used e-mail, our world could save valuable resources.	2.68	2.58	2.58
Information technology careers are boring.	1.99	2.07	2.20
It is important to have Internet access at home.	2.94	3.09	2.94
Information technology careers are only available to people with really good math skills.	1.88	1.99	1.99
As a result of using information technologies, my communication skills have gotten better. ^a	2.86	2.65	2.50
E-mail programs are important as a means of communication.	3.02	3.00	2.84

Table continued

Table 1 (continued)

Statements Regarding Information Technology	Sp 2002 <i>f</i> = 762	Sp 2003 <i>f</i> = 932	Sp 2004 <i>f</i> = 756
Careers in the information technology field sound exciting.	2.83	2.73	2.66
It is important to have Internet access available at school.	2.92	3.28	3.18
I would like to find a job that allows me to use information technology on a daily basis.	2.76	2.72	2.63
My parents think computers and information technologies are important subjects to learn.	2.99	2.90	2.80
Information technology jobs do not mean you have to be a computer programmer.	2.94	2.92	2.76
Using information technologies helps me develop marketable job skills.	2.84	2.81	2.69
Learning with information technologies is more enjoyable than learning through traditional classroom instruction.	2.91	2.87	2.68
I dislike working with information technologies.	1.93	2.06	2.07
Females should look for information technology jobs.	2.85	3.25	3.15

Note: 1.00 – 1.49 = *Strongly Disagree*, 1.50 – 2.49 = *Disagree*, 2.50 – 3.49 = *Agree*, 3.50 – 4.00 = *Strongly Agree*

“Information technology careers are only available to people with really good math skills” ($M = 1.88$), “I dislike working with information technologies” ($M = 1.93$), and “Information technology careers are boring” ($M = 1.99$).

The highest rated statement in spring 2003 was “It is important to have Internet access available at school” ($M = 3.28$) followed by “Females can be successful in an information technology job” ($M = 3.25$), “It is important to have Internet access from home” ($M = 3.09$), and “My information technology skills are adequate for me to complete my schoolwork” ($M = 3.04$). The lowest rated statements in spring 2003 were “I think information technology careers are just for males” ($M = 1.56$), “Information technology careers are only available to people with really good math skills” ($M = 1.99$), “I dislike working with information technologies” ($M = 2.06$), and “An information technology career means working only with a computer” ($M = 2.06$).

The highest rated statement in spring 2004 was “It is important to have Internet access available at school” ($M = 3.18$) followed by “Females can be successful in an information technology job” ($M = 3.15$), “My information technology skills are adequate for me to complete my schoolwork” ($M = 2.98$), and “It is important to have Internet access from home” ($M = 2.94$). The lowest rated statements in spring 2004 were “I think information technology careers are just for males” ($M = 1.62$), “Information technology careers are only available to people with really good math skills” ($M = 1.99$), “I dislike working with information technologies” ($M = 2.07$), and “An information technology career means working only with a computer” ($M = 2.10$).

Conclusions and Recommendations

Overall, students agree with a majority of the statements regarding their attitudes toward information technologies. Students agreed that it was easier to complete their schoolwork using information technologies, that minorities and females should look for and could be successful in information technology careers, and that their communication skills (both written and verbal) have gotten better through the daily use of information technologies. Students have no problem securing Internet access, either at home or at school, and believe such access is important to have in the respective locations. Students also agreed that e-mail is an important communication tool. While students are comfortable with using information technologies, they generally believe IT careers are exciting and not boring, are not solely for males, and are not only for people with good math skills or computer programming skills. Students would like to find a job that requires the use of information technologies.

When analyzing the mean scores on the statements over the three-year time period, attitudes of high school students toward information technology remained fairly stable. One positive conclusion from this study is that high school students during the third year of the study more strongly agreed that females should look for information technology jobs than their peers indicated two years earlier. The researchers would like to ascertain why more students today believe this, thus warranting additional research in this area.

Two statements which concern the researchers are “Information technology careers are boring” and “Careers in the information technology field sound exciting.” While students generally disagreed that information technology careers are boring and agreed that information technology careers sounded exciting, the differences in the levels of agreement changed each year. Based on the mean scores, the researchers can conclude that high school students today have less favorable attitudes towards information technology careers than did their peers two years earlier. With information technology playing a more important role in the lives of individuals today and with information technologies becoming more commonplace in society, could the novelty be wearing off with high school students using information technologies just like have existed for years? In reviewing Rogers (1995) work, this is true with the innovation-decision process. Further research should be developed to address this issue.

Findings from this study are congruent with those from Canada and Brusca (1991) and Ratt and deVries (1985) that females can be just as skilled and successful as males in information technology careers. While Canada and Brusca (1991) found that males had more interest in and less anxiety about computers, this study supports the perception that females need to strongly consider pursuing information technology careers because such careers are not only for male students. The bigger question to be answered is would females students who participated in this study consider such opportunities in the information technology workforce. Further research is needed to determine if females would seek information technology careers.

While Houtz and Gubta (2001) found that high school students had little or no interest in pursuing an information technology career, this study found that students agreed that they want to find a job that allows them to use information technologies on a daily basis, even though fewer statements are in agreement today than their peers two years earlier. Furthermore, more students in this study believed females should seek information technology jobs, a difference of opinion in what Bame, et. al. found when females said they would not seek information technology careers. AEST teachers should identify businesses within their communities that require the use of information technologies on a daily basis and plan instructional activities geared at preparing students for job opportunities within the local community.

Remembering what Bame, et. al. say about understanding the attitudes of students as a prerequisite to effective teaching, what can agricultural educational professionals do to further promote IT careers in agriculture? Secondary agriculture teachers must be comfortable with the use of information technologies, as stated by Kotrlik, et. al. (2000). These teachers will be the individuals who will help secondary school students develop basic information technology skills needed to progress in agricultural careers, supporting the research by Monk, et. al. (1996) that students need to be comfortable with computer and information technology skills. Research should be conducted to determine teachers’ skill levels and comfort with using information technologies and appropriate professional development opportunities should be developed to equip these teachers with the requisite skills needed to use and demonstrate information technologies with their students.

Parental and community input should be utilized when planning educational experiences for students to help them gain exposure to IT careers and the technologies available within the community. This can mean developing career awareness opportunities through career days or job shadowing experiences through a student's supervised agricultural experience program. Particularly, females and minorities employed in IT careers should be involved in such projects as we try to increase the number of females and minorities employed in the information technology workforce.

To lay the foundation for preparing students with favorable attitudes toward information technology, the agricultural education profession needs to understand the impact of information technology in agriculture. Research should be conducted to determine specific applications of information technology in agriculture. Furthermore, once these applications are identified, professional development workshops should be conducted for agricultural education teachers to help them understand and practice information technology applications in the state.

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