UNDERGRADUATE STUDENTS' CRITICAL THINKING DISPOSITIONS AND TRUST IN SOURCES OF INFORMATION ABOUT GENETICALLY MODIFIED FOOD RISK

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Master of Science

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To the Graduate School:

We are submitting a thesis by Darnell Towns entitled “Undergraduate Students’ Critical Thinking Dispositions and Trust in Sources of Information about Genetically Modified Food Risk." We recommend that it be accepted in partial fulfillment of the requirements for the degree, Master of Science in Agricultural Sciences.

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DEDICATION

For Mom and Dad. Your high expectations set a standard for my life. Your encouragement fueled my drive to accomplish my goals and aspirations.

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ABSTRACT

DARNELL TOWNS. Undergraduate Students' Critical Thinking Dispositions and Trust in Sources of Information about Genetically Modified Food Risk (under the direction of Dr. JOHN C. RICKETTS).

Risk information should be provided by trusted sources. People need access to sources in a way that allows an assessment of its credibility. The study sought to establish students' access awareness to databases and describe their degree of trust, familiarity, and reporting bias of sources of information about GM food risk. Also, the study created a critical thinking disposition profile of undergraduate students using the University of Florida Engagement, Cognitive Maturity, Innovativeness (UF-EMI) assessment. Demographical variables were examined to determine if a relationship exist between gender, ethnicity, age, major, level of education, trust in sources of information, and scores from the UF-EMI. The findings indicated the majority of students had moderate critical thinking dispositions (CTD). For the total CTD, Blacks scored higher (M=104.8158, SD=14.36) than non-Blacks (M=102.5217, SD=17.73), $t(152) = 0.022$, $P>0.05$, $d = 0.0035$. There were no significant differences between other selected variables and scores from the UF-EMI. The authors suggest more CTD research to better understand these constructs.

Keywords: critical thinking disposition, students, trust in sources of information, UF-EMI

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CHAPTER I

INTRODUCTION

The consumer seeks information regarding the benefits and risks of Genetically Modified (GM) food products. As a result, the information supplied to consumers affects their attitudes about GM foods. Information sources vary from online search engines and social networking sites to government agencies and university researchers. For this reason, this study focus on undergraduate students' critical thinking dispositions and trust in sources of information about GM food risk in the United States. This chapter presents the purpose, background, problem, and describes the significance of the study.

Purpose of the Study

The primary purpose of this study was to assess the trust undergraduate students place on information sources. Why focus on trust? Trust, as described by Priest (2001), is a "valuable commodity" that is established by individuals and may be hard to change. Rousseau, Sitkin, Burt, & Camerer (1998) defined trust as "a psychological state comprising the intention to accept vulnerability based upon positive expectations of the intentions or behavior of another" (p. 395). A classical definition of trust was presented by Rotter (1980) as a general expectation held by someone that the word, promise, oral or written statement of another person or group is reliable.

The trust consumers place on information sources is important. Specifically, the sources of information pertinent to this research are those that communicate risk

information. Kasperson and Stallen (1991)stated that “credibility of an information source is a key issue in risk communication” (p. 175) and that “risk communication is defined as a purposeful exchange of information” (p. 177). Gaskell, Allum, Wagner, Kronberger, Torgersen, Hampel, and Bardes (2004) suggest a need for a strategy of accurate risk communication from trusted sources. In addition to focusing on trust another purpose for this research was to assess why an individual’s perception of a source varies by measuring their critical thinking dispositions.

Background

An individual’s critical thinking dispositions allow critical thinking activity. Beyer (1995) stated, "Critical thinking... means making reasoned judgments" (p. 8). Basically, asserting that critical thinking uses reason to evaluate the validity of something. Critical thinking is also defined as a process that focuses on what should one believe or do (Ennis, 1994). Another definition of critical thinking is a unique kind of purposeful thinking in which the individual thinks systematically and habitually which also imposes criteria and intellectual standards on thinking. Lee, Scheufele, and Lewnstein (2005) states that when forming judgments about new technologies such as GM food products, individuals will use cognitive shortcuts, such as ideological predispositions or cues from mass media (p 241). In other words, their dispositions or attitudes inform their thought process.

College students and the general public believe that their personal experiences and those of people whom they trust are as legitimate and reliable as conclusions made from research studies as statistical averages are no match for vivid illustrations that are

experienced personally (Halpern, 1998). As a result, testimonials used by advertisers such as "I know a person who…" are used to disprove findings reported from a large scale study (Gilovich, 2001). Studies like these led two of our former presidents, George Bush and Bill Clinton, to declare it a national priority for critical thinking courses to be offered to college students (National Education Goals Panel, 1991).

Problem

Research has been conducted to determine the critical dispositions of students and some researchers have sought to look at the differences amongst variables: gender, ethnicity, age, major, and level of education. Holgado, Martinez-Gonzalez, De Irals-Estevez, Gibney, and Martinez (2000) reported that gender, education, and age were a significant factor when choosing information sources. This study focused on the critical thinking disposition scores of undergraduate students at Tennessee State University, as measured by the UF-EMI. Also, this study looked to see if relationships exist between critical thinking disposition scores, the aforementioned variables, and trust in sources of risk information about GM food risk.

Significance

This research was concerned with establishing the degree of trust, familiarity, and reporting bias the students had in various sources of information about genetically modified food risks, and explained any differences identified. Establishing a degree of trust is important as different technologies are promoted an individual's attitude towards a technology depends on the source of one's information (Teisl, Fein, & Levy, 2009). Research confirms that the public attitudes toward prevailing technologies are mainly

driven by trust in the institutions promoting and regulating these (Frewer, Scholderer, & Bredahl, 2003). This research compiled data that established relationships between degree of trust, familiarity, and reporting bias and each variable.

Second, determining if there is a correlation between critical thinking dispositions and gender, ethnicity, age, major, and level of education may allow for educators to establish development for critical thinking dispositions for undergraduate students. The results allowed for suggestions for further research and to explore the extent of the significant correlations between critical thinking dispositions and the individual variables or to assess what other variables could pose a relationship.

Lastly, this study was essential for a few reasons. First, there are 105 historically black colleges or universities (HBCUs) and only 18 percent of those institutions offer online resources and courses via their distance learning programs (Smith III, 2011). Tennessee State University (TSU) represents 1 of the 19 that offer online databases and periodicals through its distance learning program. In order to do so, 24% of the program and service fee ($112.50) is charged to the students enrolled full time (Tennessee State University, 2012). This research allowed for an assessment of the undergraduate students' awareness of access to such databases or online periodicals. The results of this study may assist administrators of the university on how to inform students of their access to various online databases or periodicals.

Research Questions

1. What are the critical thinking dispositions of TSU students?

2. Are TSU undergraduate students aware of their accessibility to online periodicals and research databases?
3. What relationships, if any, exist between participants' critical thinking dispositions and chosen demographic variables: gender, ethnicity, age, major, and level of education?
4. What relationships, if any, exist between selected demographic variables and degree of trust, familiarity, reporting bias, source credibility of information sources?
5. What relationships exist between participants' critical thinking dispositions and trust, familiarity, reporting bias, and source credibility?

Hypothesis

1. There are no relationships between students' access awareness across chosen demographic variables.
2. There are no relationships between students' critical thinking dispositions and chosen demographic variables.
3. There are no relationships between the students' selected demographic variables and the degree of trust, familiarity, and reporting bias.

Summary

This chapter introduced the study by specifying the significance of determining the trust undergraduate students place on information sources, the importance of assessing the critical thinking dispositions of the students, and the need for an evaluation of the students' knowledge of accessibility of online periodicals and databases. Chapter

two will explain the conceptual framework of the study; in addition to an exhaustive overview of the literature that currently exist on the topic.

CHAPTER II

LITERATURE REVIEW

The previous chapter introduced the study by specifying the significance of determining the trust undergraduate students place on information sources, the importance of assessing the critical thinking dispositions of the students, and the need for an evaluation of the students' awareness of accessibility of online periodicals and databases. Chapter two will explain the conceptual framework of the study; in addition to an exhaustive overview of the literature that currently exist on the topic.

Theoretical Rationale

This study relied on a compilation of literary research to establish an exploratory research design. The theory was that certain demographics make up an individual's critical thinking dispositions, or willingness to think, and that includes: age, major, level of education and gender (Irani, Gallo, Ricketts, Friedel, & Rhoades, 2007). The goal of the research was to determine the students' critical thinking dispositions and to see if relationship exists between trusts on sources of information. Trust itself is dependent upon source credibility, reporting bias, and access awareness (Hunt & Frewer,

2001). Ultimately, the trust placed on information sources changes the consumer self-confidence in decision making (Ha & Lee, 2011).

Conceptual Model

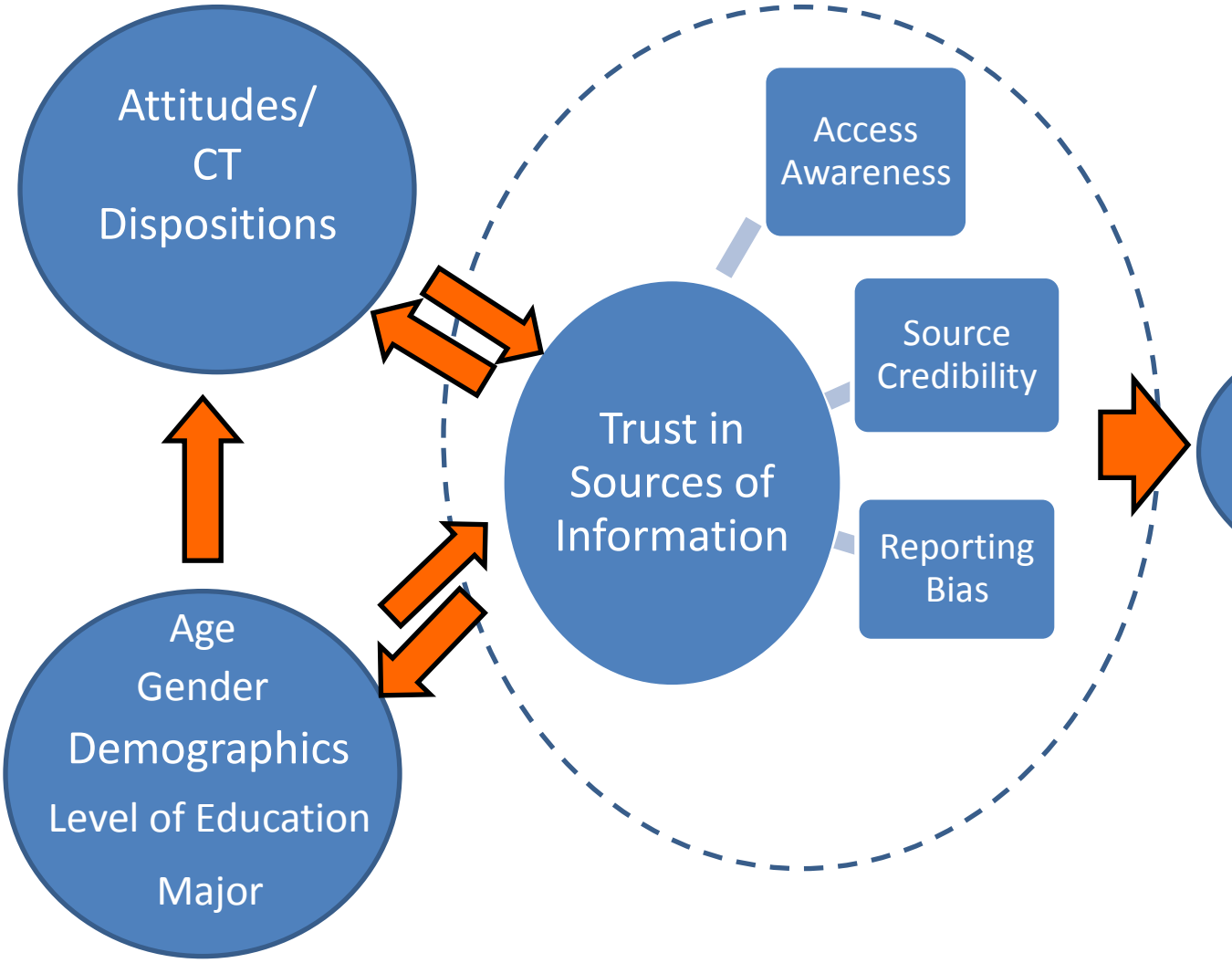

Figure 1 Conceptual model of Critical Thinking Dispositions and Consumer Trust Associations with Decision-making and GM Foods

Critical Thinking Definitions

Paul (1993) stated that "Critical thinking is thinking about your thinking while you're thinking in order to make your thinking better" (p. 91). Yinger (1980) viewed critical thinking as an intellectual activity related to evaluating outcomes of thought. Critical thinking dispositions (CTD) were described by Irani, Rudd, Gallo, Ricketts, Friedel, & Rhoades (2007) as the attitudes that individuals develop from significant influences in their lives such as adults, peers, and environmental elements that serve as an access point which allows critical thinking activities to occur (p. 3). Developing over time, dispositions are difficult to change yet possible. CTD are individual characteristics or attributes of the mind connected with the internal impulse to engage problems and form decisions using critical thinking (*Table 1*).

Critical Thinking Dispositions

Thinking critically requires cognitive work. One must develop the attitude to do this type of work. When thinking about including critical thinking courses in college it is essential to promote critical thinking dispositions, this attitude, in classroom instruction. Halpern (1998) defined critical thinking dispositions:

> A critical thinker exhibits the following dispositions or attitudes: (a) willingness to engage in and persist at a complex task, (b) habitual use of plans and the suppression of impulsive activity, (c) flexibility or open-mindedness, (d) willingness to abandon nonproductive strategies in an attempt to self-correct, and (e) an awareness of the social realities that need to be

> overcome (such as the need to seek consensus or compromise) so that thoughts can become actions (p452).

For this study, the University of Florida's EMI: Critical Thinking Disposition assessment is used where the constructs are engagement, cognitive maturity, and innovativeness (Irani, Gallo, Ricketts, Friedel, & Rhoades, 2007). A person with high disposition is willing to consider complex questions, seek various solutions, and question decisions. An engaged individual would be capable of anticipating circumstances where good reasoning will be necessary. Such a person would be confident in their reasoning, problem solving, and decision making capabilities. Furthermore, they would be able to communicate and affectively explain their reasoning. A person with a high level of

Table 1

Paul (1995) Definition for Critical Thinking

Construct	Operational Definition
A unique kind of purposeful thinking	In any subject area or topic whether academic or practical, requiring intellectual training for the mind, akin to physical training for the body.
In which the thinker systematically and habitually	Actively develops traits such as intellectual integrity, intellectual humility, fair-mindedness, intellectual empathy, and intellectual courage.
Imposes criteria and intellectual standards upon the thinking	Identifies the criteria of solid reasoning, such as precision, relevance, depth, accuracy, sufficiency, and establishes clear standards by which the effectiveness of the thinking will be assessed.
Taking charge of the construction of thinking	Awareness of elements of thought such as assumptions and point of view that are present in all well-reasoned thinking, A conscious, active, and disciplined effort to address each element is displayed.
Guiding the construction of the thinking according to the standards	Continually assessing the course of construction during the process. Adjusting, adapting, and improving using criteria and standards.
Assessing the effectiveness of	Deliberately assessing the thinking to determine its strengths and limitations according to the defining purpose,

the thinking according to the purpose, criteria, and standards	criteria, and standards. Studying the implications for further thinking and improvement.

**Derived from the University of Florida's Critical Thinking Instrumentation Manual*

cognitive maturity is aware of the factors within their thinking that creates biases towards their thought process and ultimately affects their decision making. High levels of innovativeness are present in a person who is determined to learn more about a topic or situation.

Bisdorf-Rhoades, Ricketts, Irani, Lundy and Telg (2005) provides an example of a study that measures critical thinking dispositions in their study on *Critical Thinking Dispositions of Agricultural Communications Students* that reported, cognitive maturity as the lowest disposition with an average of 29.32 (4.33). Engagement was scored the second lowest with an average of 40.04(4.49). The highest rated disposition was innovativeness with an average of 44.22(4.74). *Table 2* illustrates the ranges of critical thinking disposition scores of the agricultural communication students.

Table 2

UF-EMI Critical Thinking Dispositions Scores

Disposition	**N**	**Minimum**	**Maximum**	**M**	**SD**
Innovativeness	227	25	55	44.22	4.74
Engagement	227	22.31	50	40.04	4.49
Cognitive Maturity	227	15.56	41.11	29.32	4.33
Total CT Disposition	**227**	**72.86**	**141.89**	**113.58**	**9.68**

Bisdorf-Rhoades et al. (2005) reported in *Table 3* the critical thinking dispositions of agricultural communication students by their gender. There weren't any statistical differences between male and female. For the total disposition, $t(227) = .257$, $p>0.05$,

the highest scores were the males with an average of 114.63, whereas the females scored an average of 113.20.

Table 3

Differences in critical thinking dispositions of agricultural communication students by gender

	Gender	**N**	**M**	**SD**	**t**
Innovativeness	Male	59	44.05	5.14	-.319
	Female	168	44.28	4.60	
Engagement	Male	59	40.77	4.96	1.458
	Female	168	39.78	4.30	
Cognitive Maturity	Male	59	29.81	3.69	1.014
	Female	168	29.15	4.53	
Total CTD	Male	59	114.63	10.18	.973
	Female	168	113.20	9.5	

Lastly, Bisdorf-Rhoades et al. (2005) reported in *Table 4* the critical thinking dispositions of agricultural communication students by their level of education, which shows no associations $t(227) = .416$, $p > 0.05$. Table 4 shows no statistical significance from first year students to fourth year students for all dispositions.

Table 4

Differences in critical thinking dispositions of agricultural communication students by level of education.

Disposition	**Education Level**	**N**	**Mean**	**SD**	**F**
Innovativeness	1st Year/Freshman	30	43.52	3.54	.95
	2nd Year/Sophomore	51	44.98	4.78	
	3rd Year/Junior	79	43.70	4.78	
	4th Year/Senior	123	44.51	4.98	
Engagement	1st Year/Freshman	30	39.36	3.21	
	2nd Year/Sophomore	51	40.03	4.43	1.75
	3rd Year/Junior	79	39.28	4.46	
	4th Year/Senior	123	40.82	4.82	
Cognitive Maturity	1st Year/Freshman	30	28.97	4.08	
	2nd Year/Sophomore	51	29.63	4.99	.78

	3rd Year/Junior	79	28.73	4.99	
	4th Year/Senior	123	29.72	4.35	
Total CT Disposition	1st Year/Freshman	30	111.85	8.25	
	2nd Year/Sophomore	51	114.65	9.37	2.00
	3rd Year/Junior	79	111.70	8.60	
	4th Year/Senior	123	115.06	10.69	

Genetically Modified Foods

GM food risk information is important because the year 2012 marked the 17th year for the commercialization of GM crops (ISAAA, 2010). Yet, GM crops have not been widely accepted by the global community. Resistance to the acceptance of these specialized crops includes concerns regarding potential human health risks of newly introduced GM foods, domination of world food production by developed countries, and a lack of adequate regulation and labeling.

Despite the resistance of GM food crops, the United States is successful with its stake in GM food crops around the world. In previous years, countries that grew 97% of the global transgenic crops were the United States (53%), Argentina (17%), Brazil (11%), Canada (6%), India (4%), China (3%), Paraguay (2%) and South Africa (1%) (USDOE, 2008)The United States is able to produce such a large amount of GM crop because of the evolution of farming.

Specifically, family farming in the United States has declined as a result of urbanization and the rise of agribusiness, the practice of farming by a handful of large firms. Agribusiness has increased the acreage of GM crops. In the United States, more than ninety six percent of the agricultural crops are genetically modified. In the last decade the United States planted more than 125 million acres of GM crops, representing more than fifty percent of the global content (James, 2007). In addition, the U.S. has

more than 3,300 biotechnology companies making it the second largest nation in the world to the European Union which has over 3,377 companies (OECD, 2009).

At this point, the terms genetically modified and biotechnology has been mentioned. There are many other terms used to describe inorganic crops. These terms include biotechnology, genetic engineering, and genetically modified organisms (GMO). To a certain degree these terms are synonymous. Biotechnology is defined as a life science that pertains to the alteration of living organisms for any reason. Genetic engineering is more specific to plants that undergo a five step process in which the genome is deliberately altered by (1) gene isolation, (2) the transfer of those genes into a vector, (3) the insertion of the vector into an organism for modification, (4) the transformation of cells in that organism, and finally (5) the division of the GMO from organisms that have not been effectively modified (Peacock, 2010). As described, genetic engineering is used to create GMO. An organism refers to a living thing that can be a plant, animal, virus, bacterium, protist, or fungus that can react to a stimulus, reproduce, grow, and maintain homeostasis (Organism, 2012). In other words, GM foods are specific GMO that can be used for human consumption. For the purpose of this study, the term GM is used to describe food crops that have been altered through genetic engineering using recombinant DNA technology, unlike conventional methods that used time-tested breeding of plants and animals (Butcher, 2009).

Organic crops are the exact opposite of GM crops. Organic crops are void of any prohibited pesticides use, sewage sludge, artificial fertilizers, genetically modified organisms, and irradiation. Organic livestock signifies that producers do not use growth

hormones or antibiotics, use pure organic feed, meet animal health and welfare standards, and provide animals with access to the outdoors (USDA, 2011).

The United States Environmental Protection Agency (2011) defined pesticides as any substance or mixture of substances used to prevent, destroy, repel, or mitigate any pest. Pesticides are typically thought of as insecticides but the term also applies to herbicides, fungicides, and various other substances used to control pests. The United States law states that a pesticide is also any substance or mixture of substances intended for use as a plant regulator, defoliant, or desiccant.

Organic Valley (2011) states that artificial fertilizers use the Haber-Bosch process which combines nitrogen from the air with hydrogen at high temperature and pressure to make anhydrous ammonia (NH_3) which is the basis for all synthetic nitrogen fertilizers. The hydrogen source for the process is natural gas, a non-renewable resource that currently accounts for 80 to 90 percent of the cost of fertilizer production. The use of these fertilizers has unintended consequences to our environment, the quality of our foods, and the sustainability of our food system. A relatively small amount of the nitrogen contained in fertilizers applied to the soil is actually absorbed by plants. The rest runs off into waterways, runoff nitrogen also leaches into groundwater, and soil bacteria convert excess nitrates into nitrite ions, which can get into the bloodstream where they attach to hemoglobin molecules, reducing their ability to carry oxygen and starving the body of oxygen. Excess nitrates in the soil sometimes convert to nitrosamines, which have been shown to cause tumors in laboratory animals. Nitrate-contaminated water is

also linked to reproductive problems, urinary and kidney disorders, and bladder and ovarian cancer.

Sewage sludge is defined by Palevsky (2007) as the accumulated semi liquid organic and inorganic material separated from wastewater during treatment. Sewage sludge is developed as controlled pollutants, and contaminants are separated by mechanical, hydraulic, biological, or chemical processes. Collection, handling, transporting, and disposal of removed solids are difficult and costly.

Food irradiation as described by Josephson and Taub (2007) is the treatment of foods with ionizing radiation that makes them safe to consume and lengthens their shelf life. Irradiation is effective in removing insects and disease from food. The process is done without changing the temperature of the food and without causing significant physical or chemical effects. However, food irradiation minimally affects nutritional value and food quality.

Trust in Sources of Risk Information

Trust in sources of risk information was a major component of the conceptual model. Frewer (2003) recommended that "risk information might better be provided by a highly trusted information source" (p25). The sources of information pertinent to this research are those that communicate risk information. Kasperson (1991) stated that "credibility of an information source is a key issue in risk communication" (p. 175) and that "risk communication is defined as a purposeful exchange of information" (p. 177). If an individual does not trust the source of the information then the information being

supplied will be disregarded. This scenario is problematic as the information may in fact be useful to the receiver but the individual neglected to listen.

Kornelis, de Jonge, Frewer, and Dagevos (2007) reported that 44.5% of consumers rely on institutional sources, 22.5% rely on social interactions, and 33% were non-selective as to their source preference for GM food risk information. The institutional sources could be university scientist, agricultural extension professionals, or publications produced by a college or university. Bennett, Calman, Curtis, and Fischbacher-Smith (2010) stated that if a source is not trusted then the message from the source will be ignored.

Renn and Levine (1991) suggest that an individual primarily make their decisions based upon the source of the information and whether or not one can trust them. As a result, the trust consumers place on information sources is important. Hunt and Frewer (2001) study identified perceptions of trust as an important factor in risk communication; their study was the model for part of this research which established the level of trust consumers have on a variety of information sources about the health effects related to GM food.

Individuals were directly questioned about the level of trust they placed on information about the health effects related to GM food from various sources. Participants were also questioned about the degree to which they believed each source had a vested interest in misinforming consumers about the potential health effects related to GM food consumption, and the degree of knowledge they believed each source had about any possible health effects.

The results of the study indicated that perceptions of ``vested interest" and ``degree of knowledge" are important elements in determining levels of trust. Furthermore, the younger consumers are likely to be the most responsive audience for risk information, but general audience response to risk information is likely to be influenced by preconceptions about the source of the information, preconceptions that can be derived entirely from the name of the information source (Hunt & Frewer, 2001).

Access Awareness

Holtzclaw, Eisen, Whitney, Penumetcha, Hoey, and Kimbro (2006) suggests that students at historically black colleges and universities are underexposed to internet resources such as Pub Med and other databases because of a lack of financial resources. TSU has access to several databases through the Brown-Daniel library's online resources. So this research will not only determine how students rate various sources but also to assess if undergraduate students know if various databases exist.

Hertzum, Andersen, Andersen, and Hansen (2002) held that people require access to sources in a way that allows an assessment of a source's credibility. So it is important to ascertain that if the individuals have access to certain databases that they report whether or not this access is easily understood. Taylor-Clark, Koh, and Viswanath (2007) stated that individuals became frustrated and overwhelmed when accessing multiple internet sites. The information on websites related to risk information needs to be easily understood.

Nemeth (2010) concluded that researchers rely more heavily on sources of information from field-specific databases than other sources of information which

includes online search engines. Furthermore, a higher level of confidence is placed on field-based specific databases which have great value as they cover authenticated publications.

Familiarity and Reporting Bias

Hunt and Frewer (2001) suggested that there are relationships that exist between familiarity and reporting bias and trust in sources of information. The relationship suggests that individuals place value on the name of an organization. For instance, an organization whose name is familiar or similar to another organization may exhibit similar results. Specifically names with the same initials that have a similar acronym but completely different name may have similar familiarity scores when tested.

Turner (2007) conducted a study that demonstrated that names of news networks function as ideological cues to the viewer. These cues were perceived to present an ideological bias to the audience. The bias was measured by using a single news report as the control, the news network as the independent variable, and the dependent variables were different political philosophies of the viewer. The results showed that difference in the network shows a difference in perceived ideological bias.

Variables

Gender

Currently, research found that it is common for women to have a more positive attitudes toward organic foods (Weir & Andersen, 2001) and negative attitudes toward foods produced by biotechnology (Hossain, Onyango, Adelaja, Schilling, & Hallman, 2002). Srinivasan and Crooks (2005) stated, “Female participants have been more

precise in questioning the credibility of the author and the source of the article that they read than the male participants" (p3376).

Huston, Jackowski, and Kirking (2009) found that reporting bias and source credibility seemed to have a strong influence on trust in doctors and non-pharmacist health care professionals. Abe (1978) established that trust in interpersonal and mass media sources was affected by gender differences and resulted in a variety of psychological and behavioral responses.

Ethnicity

Ekanem, Mafuyai-Ekanem, Tegegne, Muhammad, and Singh (2006) study related character traits and the sociodemographic backgrounds of consumers to the type of sources they prefer for food risk information. Taylor-Clark et al. (2007) found that individuals with low socioeconomic positions, namely ethnic minorities, face challenges when accessing, comprehending, and using sources of risk information. Richardson, Allen, Xiao, and Vallone (2012) suggested that African Americans, Hispanics, and ethnic groups of a lower income level exhibited a lower level of trust to health care professionals than ethnic groups with higher income levels such as non-Hispanic whites.

Age

Weir, Andersen, and Millock (2005) indicated that older individuals are less likely to buy organic foods. Also, Bennett, D'Souza, Rosenberger, and Smith (2003) found positive relationship between age and attitudes toward biotechnology. A 2004 study concluded that an individual's level of education, age, and religion contributes to explaining the differences between information source preferences (Huffman, Rousu,

Shrogen, & Tegene, 2004). For instance, older individuals do not trust medical professionals and newspapers as much as younger adults (Pieniak, Verbeke, Brunso, & Olsen, 2006).

Smith (2011) research findings showed significant differences in source preferences by age. The study reported that older individuals seek information from TV and their health care provider, whereas younger individuals prefer internet and family or friends as an information source. There were also significant differences by age in how much trust adults place on the information from those sources. Quitadamo and Kurtz (2007) stated, "Ideally, students would learn the foundational tenets of critical thinking at an earlier age, and be able to refine and hone these skills as they progress through the K–20 education system" (p. 152).

Major

Lampert (2007) suggests that a great deal of research is required to compare critical thinking dispositions of undergraduate students. Currently there is a gap in critical thinking disposition research that examines the relationship between academic majors and critical thinking dispositions (Walsh & Hardy, 1999). Teisl, Fein, and Levy (2009) suggested there is a function of the type of education attained. For example, there is evidence that people's attitudes toward food technologies increases with level of science education (Sturgis & Allum, 2000, 2001).

Level of Education

Education has been found to have positive (Weir & Andersen, 2001) effects on organic food purchases. Similarly, some researchers have found that more educated

individuals are more accepting of biotechnology (Hossain, Onyango, Adelaja, Schilling, & Hallman, 2002). Giancarlo and Facione (2001) conducted a longitudinal study from 1992 to 1996 that found as students matriculated through college their disposition to think critically increased. Pieniak, Verbeke, Scholderer, Brunso, & Olsen (2006) related a higher level of education with a preference for consumer organizations, magazines, newspapers, friends, books, government agencies, and food labels. The findings of Holgado et al. study (2000) proved that education levels have an impact on trust in certain information sources.

CHAPTER III

METHODS AND PROCEDURE

Purpose of the Study

The primary purpose of this study was to assess the trust undergraduate students place on information sources and why an individual's perception of a source varies by measuring their critical thinking dispositions. This was achieved using the UF-EMI assessment and comparing the results with demographical variables and data obtained from the adapted Hunt et al. survey (2001). The previous chapters addressed the foundation of this study which included the theoretical rationale, conceptual model, and related literature. This chapter will explain the design, sampling, instrumentation, data analysis, and IRB approval for this study.

Research Objective

The objectives if this research were to create a profile of critical thinking dispositions of undergraduate students, to establish their accessibility of access to online periodicals and research databases, and describe students degree of trust, familiarity, and reporting bias of information sources. In addition, this study also sought to compare the findings of the aforementioned objectives to selected variables: gender, ethnicity, age, major, and level of education.

This research sought to answer the following research questions: (1) what are the critical thinking dispositions of TSU students? (2) Are TSU undergraduate students aware of their accessibility to online periodicals and research databases? (3) What relationships, if any, exist between participants' critical thinking dispositions and chosen demographic variables: gender, ethnicity, age, major, and level of education? (4) What relationships, if any, exist between selected demographic variables and degree of trust, familiarity, and reporting bias of information sources?

The study aimed to test the following hypothesis: (1) there are no relationships between students' access awareness across chosen demographic variables. (2) There are no relationships between students' critical thinking dispositions and chosen demographic variables. (3) There are no relationships between the students' selected demographic variables and the degree of trust, familiarity, and reporting bias.

Research Design

An exploratory research design was used to collect data about undergraduate students at Tennessee State University. While research exists, individually, in the area of

critical thinking dispositions, risk communication, and trust, little to no research is present that focused on establishing correlations between the three fields especially not of undergraduate students at a historically black college or university. There are studies focused on the critical thinking dispositions of nursing students, fine arts students, and teachers. As a result, this research was looked at science majors which focus was to gain insights and familiarity for later investigation and to make comparisons to other studies.

Sampling

The intended population for this study was all 2012 Maymester students at Tennessee State University. A list of instructors teaching the Maymester courses offered were attained from Tennessee State University website via the banner services course search link. The link identified courses offered including online, hybrid, and conventional instructional methods. Only the courses that utilized the conventional instructional method were used as the population. As a result, this study used a convenience sampling. A total of 452 students were enrolled during this study. Surveying all students available, our sample is composed of 154 students.

Instrumentation

The survey instrument used for this thesis is a partial replication of earlier studies concerned with "Trust in Sources of Information about Genetically Modified Food Risk in the United Kingdom" (Hunt & Frewer, 2001) and "Consumer Trust in Extension as a Source of Biotech Food Information" (Ekanem, Mafuyai-Ekanem, Tegegne, Muhammad, & Singh, 2006). This study is unique in that it has an emphasis on United States based sources of information and includes social networking. Whereas earlier studies focused

on individuals located in the United Kingdom and lacked questions regarding most recent internet firms. Furthermore, this research assesses participants' critical thinking disposition by measuring their engagement, cognitive maturity, and innovativeness using the University of Florida's EMI instrument (Irani, Gallo, Ricketts, Friedel, & Rhoades, 2007).

In the present research there were thirteen questions in total. The first addressed students' access awareness and was as follows: "Do you have access to the following databases?" Respondents could have marked a simple "yes" or "no". The second question addressed familiarity with named organizations in the questionnaire, and was as follows: "Please indicate whether or not you have heard of the following organizations?" Answers could fall into one of two categories – "definitely have heard" or "definitely have not heard". The organizations were:

- Center for Disease Control and Prevention
- Department of Health
- United States Department of Agriculture
- Council for Consumer Protection
- Environmental Protection Agency
- Food and Drug Administration
- Green Peace
- World Health Organization
- United Nation Food and Agriculture Organization
- President's Council on Bioethics
- Biotechnology Industry Organization
- Center for Food Safety
- Council for Biotechnology Information
- Department of Agriculture Animal and Plant Health
- National Center for Biotechnology Information
- Crop Life America
- Center for Biologics Evaluation and Research

Students were also presented with the following three questions about 23 possible sources of health risk information:

(1) “To what degree would you trust information about possible health effects associated with consuming genetically modified food from each of the following?"

(2) “To what degree do you think that each of the following has a vested interest in misinforming the general public about the possible health effects associated with consuming genetically modified food?"

(3) “To what degree do you think that each of the following has the factual information necessary to inform the general public about the possible health effects associated with consuming genetically modified food?"

The remaining questions were the University of Florida’s EMI instrument and demographical questions which asked the individuals gender, ethnicity, age, major and current education level.

After the survey instrument was developed, approval for human subject was sought from TSU Internal Review Board (IRB). On April 26, 2012, this study was approved. The IRB protocol number for this study is HS2012-3005. The FWA for Tennessee State University is #00007692, which is effective from July 8, 2011 to July 8, 2016.

Data Collection Procedures

A convenience sample of 154 was taken from a population of 452 Maymester students at Tennessee State University during May of 2012. The Maymester population

surveyed was only the courses whose students were easily accessible. The courses were limited to the Floyd Payne campus courses that were taught using the conventional instructional method, in a classroom setting not including online, distance education elearn courses, or hybrid courses.

Data Analysis

Once survey instruments were collected, data was coded and information was input into the computer using Microsoft Excel software. Statistical Package for the Social Sciences (SPSS) / Microsoft Excel Analysis Tool pack was used for analysis. Descriptive statistics such as the mean, variance, and standard deviation will be used to describe the data collected. Graphs and tables were used to describe and illustrate the data.

For the section of the questionnaire measuring EMI, constructs will be computed independently by adding the points obtained from the five point Lykert scale (1=Strongly Agree and 5=Strongly Disagree). To compute the overall CTD of an individual, the responses obtained from all 26 items will be added together. In the case of a missing response, one item from each construct will be omitted. In the event of multiple missing responses, that particular scale will not be scored.

CHAPTER IV

RESULTS

At the completion of the study a total of 154 students were surveyed. Of the students surveyed, a reported 60.5 percent were female and 39.5 percent were male. The ethnicities of the populations were categorized into two groups: blacks, who represented 82.2 percent of surveyors, and non-blacks that represented 17.8 percent of surveyors. Furthermore, the students were classified based on their level of education. This study reported that fourth or fifth year seniors represented the majority of our sample at 37.6 percent, third year/juniors were 36.2 percent, second year/sophomores were 21.5 percent, and first year/freshman were 4.6 percent. This chapter reports the findings of the study.

Objective One: Critical Thinking Disposition of TSU Students

The total possible score for innovativeness ranges from 7 to 35, engagement from 11 to 55, and cognitive maturity from 8 to 40. The total UF-EMI score ranges from 26 to

130. A score of 106.7 and above represents a critical thinking disposition that is strong; 85.9 to 106.6 represents a disposition that is moderate; and 85.8 and below represent a disposition that is weak (Bisdorf-Rhoades, Ricketts, Irani, Lundy, & Telg, 2005).

TSU students scored the highest for the engagement disposition with a mean of M=48.2876, SD=7.93864. The second highest score was the cognitive maturity with a mean of M=31.3725, SD=4.58241. The lowest scored disposition was innovativeness with a mean of M=27.778, SD=4.50179. For the total critical thinking disposition, TSU undergraduate students had a mean score of M=103.6993, SD=15.04646.

Table 5
Critical thinking disposition profile of TSU students

Disposition	**N**	**Min**	**Max**	**Ranges**	**M**	**SD**
Innovativeness	153	13	35	7-35	27.7778	4.50179
Engagement	153	28	88	11-55	48.2876	7.93864
Cognitive Maturity	153	17	40	8-40	31.3725	4.58241
Total CT Disposition	**153**	**60**	**142**	**26-130**	**103.6993**	**15.04646**

Objective Two: TSU Undergraduate Students Access Awareness

For the sources that were accessible on Tennessee State University database link through the library and media center online, undergraduate students reported that they did not have access to the databases with averages between 66 to 90.8 percent. Nature magazine was the highest scoring database, 34 percent of students said they did have access. Agricola and Scirus were the two databases that had the lowest scores a reported 9.2 percent of students replied that they had access to those databases.

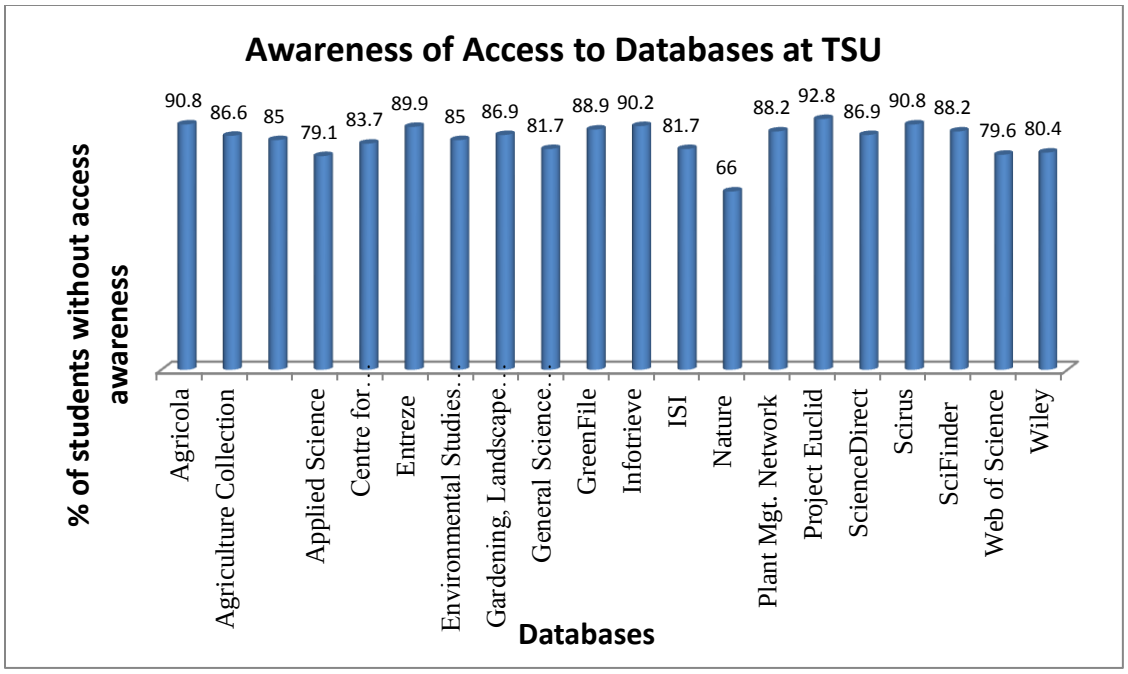

Figure 2 Access awareness

Objective Three: Relationships between Students Critical Thinking Dispositions and Demographic Variables

Gender

Table 6 shows females scored an average of M=103.8072, SD=14.63. Males scored an average of M=105.389, SD=15.47 on the total critical thinking disposition. The total critical thinking disposition was not statistically significant, $p > 0.05$. Also, for the individual constructs of innovativeness, engagement, and cognitive maturity there were not any statistical or practical significance.

Table 6
Differences in male and female critical thinking dispositions

Disposition	Gender	N	M	SD	t	sig	Cohen's d
Innovativeness	Male	60	28.44	4.43	1.252	.213	0.2031
	Female	92	27.59	4.54			
Engagement	Male	60	48.72	7.95	.326	.745	0.0528
	Female	92	48.54	8.08			
Cognitive	Male	60	32.04	4.80	1.279	.203	0.2075

	Female	92	31.36	4.06			
Total CT	Male	60	105.39	15.47	.883	.379	0.1432
	Female	92	103.81	14.63			

Ethnicity

Blacks scored an average of M=104.8158, SD=14.36 on the total critical thinking disposition. Non-Blacks scored an average of M=102.5217, SD=17.73 on the total critical thinking disposition. The total critical thinking disposition is statistically significant t(152) =0.022, P>0.05, d =0.0035. However, innovativeness, engagement, and cognitive maturity were not statistically significant.

Table 7
Differences in critical thinking dispositions based on ethnic background

Disposition	**Age**	**n**	**M**	**SD**	**t**	**Sig**	**Cohen's d**
Innovativeness	Blacks	125	28.02	4.20	-.250	.077	-0.040
	Non-	27	27.48	5.86			
Engagement	Blacks	125	48.80	7.97	.072	.943	0.011
	Non-	27	47.70	8.29			
Cognitive	Blacks	125	31.73	4.25	-.084	.243	-0.0137
	Non-	27	31.13	4.95			
Total CTD	Blacks	125	104.82	14.36	.022	.982	0.0035
	Non-	27	102.52	17.73			

Age

Students 21 years of age and older scored an average of M=104.6857, SD=13.60 while students under the age of 21 scored an average of M=104.1642, SD= 16.31 on the total critical thinking disposition. The total critical thinking disposition is not statistically significant. Also, for the individual constructs of innovativeness, engagement, and cognitive maturity were not statistically significant.

Table 8
Differences in critical thinking dispositions based on age

Disposition	Age	n	M	SD	T	sig	Cohen's d
Innovativeness	Under	70	28.23	4.36	.801	.425	0.130
	21+	67	27.61	4.65			
Engagement	Under	70	48.67	6.87	.087	.931	0.014
	21+	67	48.55	9.09			
Cognitive	Under	70	31.47	4.03	-.428	.670	-0.0698
	21+	67	31.79	4.71		.	
Total CTD	Under	70	104.69	13.60	.204	.839	0.0333
	21+	67	104.16	16.31			

Major

Non-Science majors scored an average of 16.34347, while science scored an average of 13.35102 on the total critical thinking disposition. The total critical thinking disposition is not statistically significant. Also, for the individual constructs of innovativeness, engagement, and cognitive maturity there were not any statistical or practical significant.

Table 9
Differences in non-science and science critical thinking dispositions.

	Major	N	M	SD	t	Sig	Cohen's d
Innovativeness	Non-Science	84	27.56	4.89	-.660	.510	-0.1074
	Science	69	28.04	3.99			
Engagement	Non-Science	84	47.74	7.90	-.944	.347	-0.1536
	Science	69	48.96	7.99			
Cognitive	Non-Science	84	31.32	5.023	-.152	.880	-0.0247
	Science	69	31.43	4.02			
Total CTD	Non-Science	84	102.89	16.34	-.730	.466	-0.118
	Science	69	104.68	13.35			

Level of Education

Level of education was not associated with critical thinking disposition, as shown in *Table 10* first year students showed no statistical significance from seniors on innovativeness, engagement, and cognitive maturity. Five year seniors scored a total

critical thinking disposition of M=104.7692, SD=15.94 while first year students scored a total of M=102.00. SD=21.76.

Objective Four: Relationships between Degree of Trust, Familiarity, Reporting Bias, Source Credibility and Demographic Variables

Degree of Trust

Table 12 showed the significant relationships exist between trust (x_1) in sources of information and the students reporting bias (x_2) where the Pearson correlation was r=.25 and source credibility (x_3) r=.52, p>0.05. There are no statistically significant relationships between degree of trust and familiarity (x_{10}) of named organizations, level of education (x_4), age (x_5), major (x_6), gender (x_7), and ethnicity (x_8).

Table 10
Differences in critical thinking dispositions by years in college

Disposition	Education Level	N	M	SD	F	Sig
Innovativeness	1st Year/Freshman	7	28.14	7.52	1.113	.353
	2nd Year/Sophomore	32	29.16	3.89		
	3rd Year/Junior	54	27.61	4.27		
	4th Year/Senior	43	27.00	4.48		
	5 Years Or More	13	27.85	4.71		
	Total	149	27.81	4.481		
Engagement	1st Year/Freshman	7	48.43	10.52	.394	.813
	2nd Year/Sophomore	32	49.69	6.92		
	3rd Year/Junior	54	48.15	6.77		
	4th Year/Senior	43	47.35	9.96		
	5 Years Or More	13	48.46	7.05		
	Total	149	48.29	7.99		
Cognitive	1st Year/Freshman	7	29.14	5.76	.918	.455
Maturity	2nd Year/Sophomore	32	32.09	3.91		
	3rd Year/Junior	54	31.54	4.45		
	4th Year/Senior	43	30.79	4.76		
	5 Years Or More	13	32.23	5.36		
	Total	149	31.39	4.57		
Total CTD	1st Year/Freshman	7	102.00	21.76	.690	.600
	2nd Year/Sophomore	32	107.13	12.48		

3rd Year/Junior	54	103.54	14.01
4th Year/Senior	43	101.44	16.76
5 Years Or More	13	104.77	15.94
Total	149	103.74	15.05

Familiarity

Students were asked if they "definitely have heard" or if they "definitely have not heard" of various organizations which assessed their familiarity with various organizations.

Figure 3 shows a reported 88.3% of the students definitely have not heard of the President's Council on Bioethics and 86.4% definitely have not heard of the Council for Biotechnology Information. However, 90.3% were familiar with the department of health and 84.4% were familiar with the Food and Drug Administration.

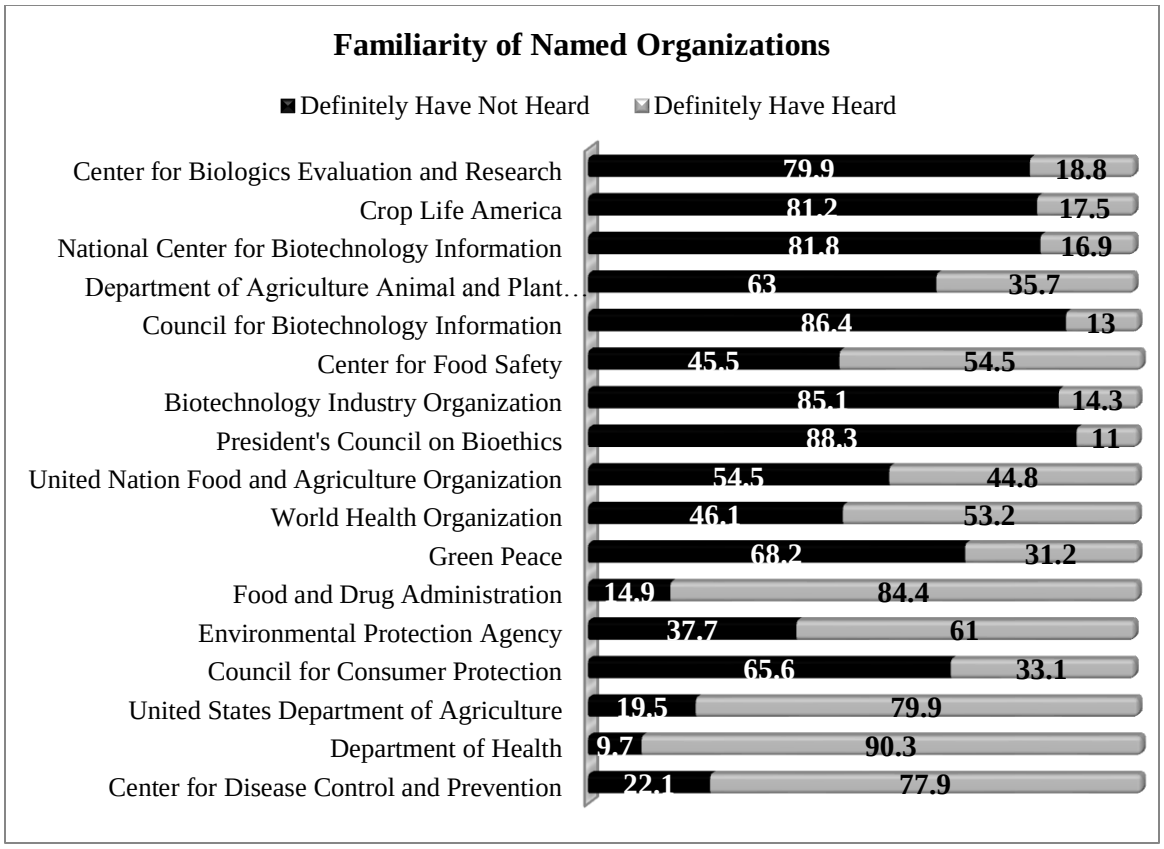

Figure 3 Familiarity of named organizations

Reporting Bias

On a four point scale where zero means no vested interest and three means large vested interest (see *Table 11*), undergraduate students at Tennessee State University reported that they think online search engines has the largest vested interest (1.85) and family and friends has the 2nd largest vested interest (1.81) to purposefully misinform the public about health effects associated with consuming genetically modified food. Furthermore, the students believed that extension professionals have the least vested interest (1.11) and Green Peace has the 2nd least vested interest (1.13).

Table 11

Trust in sources of information about GM food risk

Source	Reporting Bias (0-3)		Source Credibility		Trust	
	Mean	SD	Mean	SD	Mean	SD
Magazines	1.79	.927	2.70	1.509	1.25	.783
The Tennessean	1.43	.967	3.19	1.413	1.49	.836
Family/Friends	1.81	1.075	2.95	1.387	1.88	.827
EPA	1.37	1.031	3.53	1.635	1.89	.863
Online Search Engines	1.85	1.062	3.25	1.616	1.48	.884
Food and Drug Administration	1.73	1.045	4.27	1.500	2.14	.823
World Health Organization	1.53	1.089	4.04	1.610	2.04	.908
Facebook	1.77	1.123	2.09	1.843	.79	.835
Twitter	1.75	1.145	2.06	1.866	.75	.831
The Meter	1.20	.979	2.11	1.620	1.07	.848
TV News Reporter	1.62	1.004	2.94	1.661	1.43	.831
University Scientist	1.31	1.012	3.31	1.670	1.78	.819
Extension Professionals	1.11	.893	2.95	1.718	1.65	.891
Radio News Reporter	1.37	.937	2.69	1.554	1.73	.903
Government Scientist	1.40	1.032	3.52	1.827	1.45	1.887
Green Peace	1.13	1.049	3.14	1.758	1.56	.859

Political Officials	1.40	1.057	2.66	1.750	1.22	.903
Health Care Professionals	1.64	1.113	3.86	1.656	2.01	.857
Grocers	1.51	1.048	2.85	1.679	1.30	.898
CDC	1.48	1.151	4.17	1.669	2.16	.899
Department of Health	1.76	1.155	4.42	1.613	2.32	.856
USDA	1.52	1.162	4.15	1.784	2.17	.923

Table 12

Relationships between critical thinking dispositions, demographics, trust in sources of information, familiarity, reporting bias, and credibility of sources

Variables	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	X_{10}	Y_1	Y_2	Y_3	Y_4
Trust (X_1)	1	.25*	.52*	-.04	.08	.09	.00	-.13	.08	.07	.22*	.22*	.16*	.22*
Reporting Bias (X_2)		1	.26*	-.03	.16	.04	-.04	-.04	.22*	.11	.03	.01	.04	.02
Source Credibility (X_3)			1	-.06	.00	.09	-.03	-.09	.02	.18*	.25*	.20*	.21*	.24*
Level of Education (X_4)				1	.64*	-.14	-.09	-.06	-.09	-.04	-.07	.01	-.12	-.07
Age (X_5)					1	-.14	-.14	.03	.17*	.02	-.01	.04	-.07	-.02
Major (X_6)						1	.22*	.06	.02	.08	.08	.01	.05	.06
Gender (X_7)							1	.02	-.13	-.19*	-.03	-.10	-.10	-.07
Ethnicity (X_8)								1	-.06	.05	-.01	.01	.02	-.00
Access Awareness (X_9)									1	.21*	-.09	-.04	.02	-.06
Familiarity (X_{10})										1	.19*	.21*	.25*	.23*
Engagement (Y_1)											1	.71*	.82*	.95*
Cognitive Maturity (Y_2)												1	.75*	.87*
Innovativeness (Y_3)													1	.91*
Total CTD (Y_4)														1

*Correlation is significant at the 0.05 level (2-tailed).

CHAPTER V

DISCUSSION AND CONCLUSIONS

Introductions

The previous chapters outlined the importance of studying undergraduate students' critical thinking dispositions and trust in information sources about genetically modified food risk. The theoretical rationale and conceptual model was established from an overview of the literature to the related topics. The methodology involved a compilation of data from a survey of 154 students during May of 2012. The results will be discussed in this chapter and suggestions will be made for further research.

Review of Methods

This study utilized a convenience sampling which is a relatively small sample sizes and, thus, findings cannot be generalized to the population at large. The students at Tennessee State University were chosen because the sample of individuals provides an opportunity to test the hypotheses. Furthermore, TSU students were chosen due to convenience, the ability to personally distribute survey instruments at a low cost and to ensure a higher response rate.

Specifically, Maymester courses at Tennessee State University were surveyed. As a result, the population of the students that were not sampled during the traditional spring, summer, or fall semesters. This study utilized convenience sampling. If time permitted a random sampling of the student population from all semesters would have been best.

Also, survey instruments were given during lectures where classes were in a condensed format and time was important. Surveying during a specialized semester such as Maymester proved to be difficult as some instructors were reluctant to sacrifice time for the study resulting in a lower response rate.

Furthermore, instructors only allowed access to their class for one session; therefore, respondents absent for the day did not have the option to participate in the study. Also, there were several occasions where the student enrolled in one course was also enrolled in another course, as is expected. However, there was not a way to account for individuals enrolled in two or more courses. An accurate account of those individuals may yield a higher percentage of the population. Lastly, few instructors recommended having the instrument both as a hard copy and as a soft copy available online.

Discussion and Implications

Objective One: Critical Thinking Dispositions of TSU students

Bisdorf-Rhoades, Ricketts, Irani, Lundy, and Telg, (2005) reported in their study on *Critical Thinking Dispositions of Agricultural Communications Students* that engagement scored between the ranges of 22.31 to 50 with an average score of M=40.04, SD=4.49. Tennessee state University students in this study had engagement as the disposition with a mean of M=48.29, SD=7.94, slightly higher than that of previous studies. The Engagement disposition measured students' willingness to look for opportunities to utilize their reasoning skills and have confidence in their ability.

High levels of innovativeness are present in a person who is determined to learn more about a topic or situation. Bisdorf-Rhoades, et al., (2005) reported an average score

M= 44.24, SD=4.74for the innovativeness construct which is higher than the findings of this study where the average was M=27.78, SD=4.50. This score showed a weak disposition.

Individuals who score high on the cognitive maturity constructs are aware of the factors within their thinking that creates biases towards their thought process and ultimately affects their decision making. Bisdorf-Rhoades, et al., study reported an average score M=29.32, SD=4.33. This study reported slightly higher scores for cognitive maturity disposition with an average of M=31.3725, SD=4.58241.

A score of 106.7 and above represents a critical thinking disposition that is strong; 85.9 to 106.6 represent a disposition that is moderate; and 85.8 and below represent a disposition that is weak. This study reported for the total critical thinking disposition a mean score of M=103.70, SD=15.05, representing a disposition that is moderate.

The overall findings for the critical thinking dispositions of TSU students suggest that the students are engaged thinkers. Their critical thinking disposition scores for the total disposition are moderate. These findings, when compared to other studies are lower. However, TSU population is quite different than most studies as students do not have access to critical thinking courses and the majority of the population is African-American, and other minority ethnic groups. Whereas, other universities conducting similar research have different demographics and may offer critical thinking courses or critical thinking is a component of a core course.

Objective Two: TSU Undergraduate Students Access Awareness

Students reported that they did not have access to the majority of the databases offered at TSU between 66 to 90.8 percent. This means that 9.2 to 34 percent of the students reported that they did have access to the database. These databases were offered on the TSU library and media center website and some are offered as hardcopy journals on the main campus library. Furthermore, regression analysis confirmed that there is a relationship between access awareness and age r=.17, p>0.05. There is a weak relationship that shows older individuals are aware of their access to databases.

Objective Three: Relationships between Students Critical Thinking Dispositions and Demographic Variables

There were no significant differences between individuals' gender and critical thinking disposition. There was a significant difference between the individuals' ethnicity and critical thinking disposition. Blacks were slightly higher with a mean of M=104.82, SD= 14.36 and non-blacks with a mean of M=102.52, SD=17.73 and a t (152) = .022, p>0.05. There were no significant differences between the age of participants and their critical thinking dispositions.

Objective Four: Relationships between Degree of Trust, Familiarity, Reporting Bias, Source Credibility and Demographic Variables

The only significant relationships exist between trust (x_1) in sources of information and the students reporting bias (x_2) where the Pearson correlation was r=.25 and source credibility (x_3) r=.52, p>0.05. Familiarity of named organizations (x_{10}), level

of education (x_4), age (x_5), major (x_6), gender (x_7), and ethnicity (x_8) did not show any significant relationships.

Conclusions

The research questions were (1) what are the critical thinking dispositions of TSU students? (2) Are TSU undergraduate students aware of their accessibility to online periodicals and research databases? (3) What relationships, if any, exist between participants' critical thinking dispositions and chosen demographic variables: gender, ethnicity, age, major, and level of education? (4) What relationships exist between selected demographic variables and degree of trust, familiarity, and reporting bias of information sources?

The study aimed to test the following hypothesis:

1. There are no relationships between students' access awareness across chosen demographic variables.
2. There are no relationships between students' critical thinking dispositions and chosen demographic variables.
3. There are no relationships between the students' selected demographic variables and the degree of trust, familiarity, and reporting bias.

We are inclined, to reject, null hypothesis (1) that there are no relationships between students' access awareness across chosen demographic variables. Based on the results of the study, there is a relationship between access awareness and age $r=.17$, $p>0.05$. We fail to reject the null hypothesis (2) that there are no relationships between students' critical thinking dispositions and chosen demographic variables. We also reject

the null hypothesis (3) there are no relationships between the students' selected demographic variables and the degree of trust, familiarity, and reporting bias.

Figure 4 illustrates the relationships established from this study. With the exception of age showing a relationship to access awareness, the other variables did not seem to show a relationship to critical thinking dispositions or trust in sources of information.

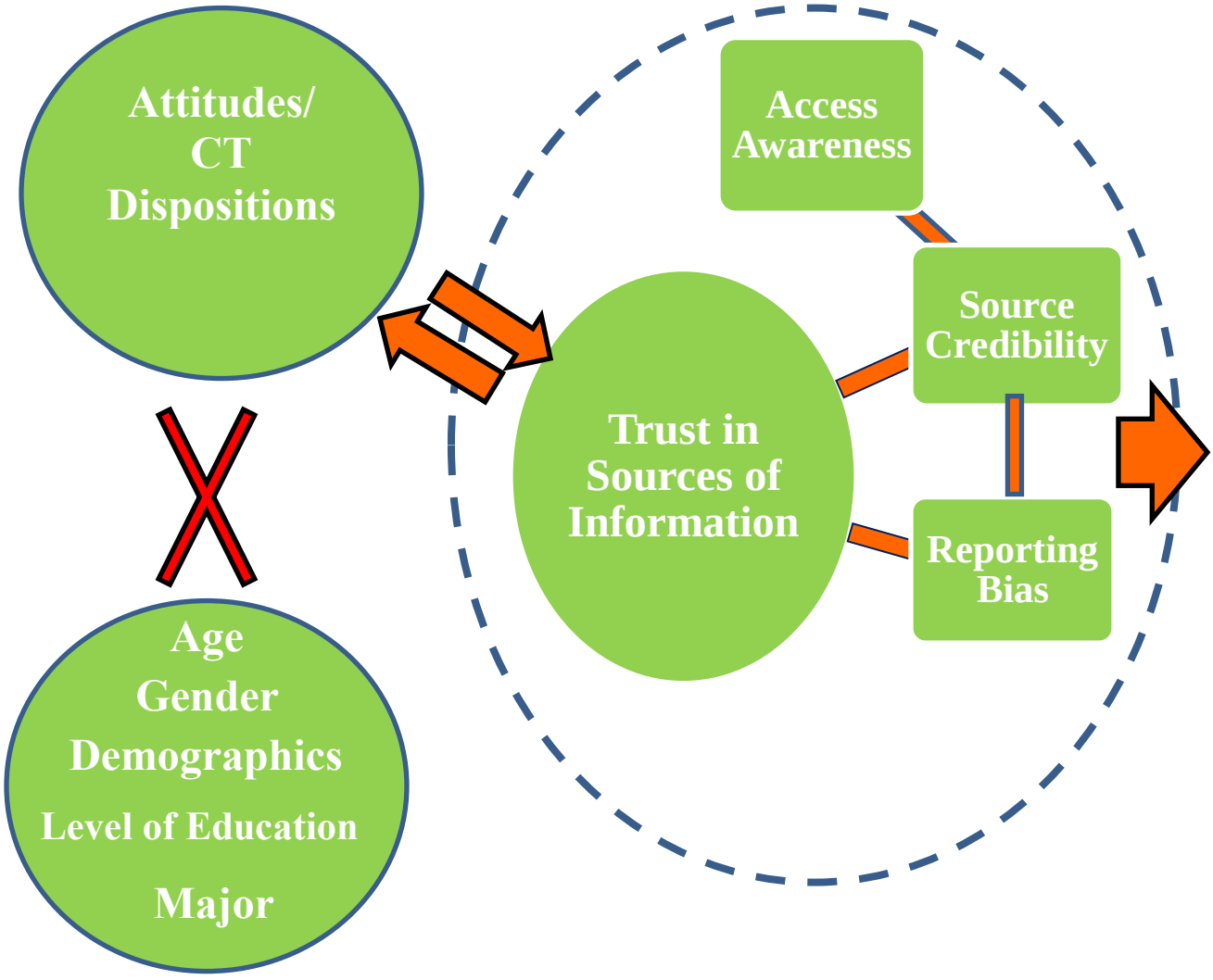

Figure 4 Proposed conceptual model for Critical Thinking Dispositions and Consumer Trust Associations with Decision Making and GM Foods

Recommendations

The nature of this study does not allow definitive conclusions about the findings. The research process although structured led to only tentative results that have limited value in decision-making an exhaustive study should be conducted. Specifically, a longitudinal study would test participants' critical thinking disposition, over a period of time, as the level of education increases. This kind of study would allow for an exhaustive analysis of the theoretical framework. Furthermore, there is a need for research on the relationship between decision making and critical thinking as relates to trust in sources of information about genetically modified food risk.

Critical Thinking Dispositions of TSU students were moderate. Dispositions are skills, or an attitude, that can be taught. Therefore, it is recommended that critical thinking be included in core courses. Specifically, critical thinking should be offered as a course that every student has to take. This could be offered as a component in a freshman orientation or an English course.

TSU undergraduate students' access awareness responses were low, suggesting that many students are unaware of their accessibility to online databases. TSU library or faculty and staff can collaborate to develop an action plan which would allow for a workshop or an in depth tour of the library media center. This workshop or tour should allow students to become acclimated with the various technological support systems they have available to them while studying at TSU.

Lastly, researchers should continue to expand the scope of understanding the relationships between critical thinking dispositions and demographical variables. Educators would benefit from critical thinking studies. Universities are currently capable of incorporating critical thinking courses into their programs of study; however, teaching critical thinking dispositions would enable students to perform the cognitive work.

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