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This study analyzes, compares, and contrasts the components of the definition of information overload, its primary sources, its frequency, its effect on work, and the utilization of coping strategies of ninety-eight full-time undergraduate university students by evaluating their responses to five open-ended questions.

The results of the study indicate that the students' definitions of information overload contain primarily volume and time constraint components, the primary source is classes, it occurs often, has a negative effect on class work, results in loss of time and reduces efficiency for the students. The majority of the students utilize coping strategies of prioritizing work, organizing work and taking a break when they experience information overload.

Headings:

Information overload—Management

Information society—Information overload

Personal information management—Information overload

AN ANALYSIS OF INFORMATION OVERLOAD COMPONENTS, SOURCES, FREQUENCY, EFFECT ON PERFORMANCE AND COPING STRATEGIES UTILIZED BY FULL-TIME UNDERGRADUATE UNIVERSITY STUDENTS

by
Virginia Beth Ellington

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Approved by

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Paul Solomon

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Introduction

Saturation is a chemical process whereby a solution can no longer dissolve a substance. A solution is defined as saturated when you continue adding the substance to the solution and the same amount of substance precipitates from the solution. This means that the solution and the substance have reached their saturation point, where no more of the substance can be absorbed by the solution. The only way that this chemical process can be altered is by a change in temperature or pressure. This concept of saturation, or the inability to further absorb, can be applied to information overload and its effect on humans, however, a change in temperature or pressure cannot cause a human to absorb more information. Therefore, humans may develop approaches to extend their capabilities for absorption or alternatively to reduce or otherwise manage the information which they encounter.

Humans, unlike computers, do not have the ability to add memory to enhance the performance of their information storage, processing and retrieval capabilities. There has been a tendency with the advancement of computer technology, to ignore the fact that as the computer's capacity for storage, processing, and retrieval of information has increased, the human capacity has reached a plateau or saturation point. This research attempts to understand the effects of information overload on full-time undergraduate university students by analyzing its components, its sources, its frequency, its effect on performance and the coping strategies utilized to minimize its effect.

Literature Review

The more information we are able to store and retrieve via computers, the more we humans are expected to absorb. This has created the problem of information overload, which has been studied with the aim of reducing the negative effects on humans caused by the rapid advancement of technology and the computer's ability to store, retrieve, process and manipulate large amounts of data. Many studies have defined, analyzed, and evaluated the concept of information overload and its effect on human capital, performance, stress, anxiety, and health. These studies have been conducted to understand the relevance of information, and to develop methods for recognizing when overload is affecting the performance of those being bombarded with the information. This literature review explores research attempting to categorize and minimize information overload, a topic that must be addressed as humans rapidly approach the information saturation point of diminishing returns.

A 1996 study of 1300 people in the United States, United Kingdom, Hong Kong, Singapore, and Australia, revealed that there are both business and human costs associated with information overload. In the foreword to this study, Lewis (1996) coined the term "information fatigue syndrome" to capture the detrimental effects to mental and physical health caused by information overload. Lewis also defined the condition of "analysis paralysis" as when an individual refuses to make a decision, because they never feel they have collected enough information to make the decision and continue to collect it infinitely. At the extreme information overload adversely effected participants' decision making ability, damaged their personal lives, and caused them to develop stress

related health problems, while decreasing their motivation and morale. The coping strategies that evolved from the study were as follows: (1) Pace yourself when dealing with a large amount of information, (2) Take breaks to give your brain time to absorb the information, and (3) Learn when to skim information instead of studying the information. Lewis also stressed not letting the inability to handle too much information kill you. This study was significant because it first identified the connection between information overload and stress related health problems in the business world.

Shenk (1997) describes the term as “data smog” implying the polluting of our surroundings by information overload. Shenk has found a correlation between computers and human self image, and that dependence upon computers can make individuals feel incomplete or inadequate without them. Shenk suggests three main coping strategies for information overload: (1) Be Your Own Filter, (2) Simplify and (3) Take a Break. One interesting common sense approach derived from this study suggests restricting your television, cell phone and computer time, by just turning them off to eliminate the source. These information management strategies can be utilized to cope with information overload by developing a plan to modify lifestyles that adjust to and perhaps limit the influx of information. By utilizing these strategies the individual and organization can achieve a goal of increased information quality and decreased information quantity.

The reason that society is unable to stem the flow of information, and is approaching the information saturation point may be largely due to the Web and the Internet. A study of information overload due to the Web was conducted by Berghel (1997), where he defined the problem to be that the Web is trying to fill the dual role of being both a personal and global information source and a communication medium, thus

attracting a wider audience. This phenomenon causes the medium to drown out most of the useful content, and reduces its effectiveness for wider audiences. Berghel uses the example of the rise and fall of citizens band radio, where the success of the medium demand was not anticipated and the channels could not handle the volume of the traffic created. Berghel's study suggests a need for personal information, or software agents, with information customization software, integrated with push and repel technology, to limit that amount of information that the individual originally receives. An information customization prototype was developed as part of this study, moving the responsibility for the organization, prioritization and ranking of information messages to agents, so that information is filtered prior to reception, thus stemming the flow. By limiting the influx of information this model can reduce information overload for both individuals and organizations in their search for information on the Internet.

Information overload has also been compounded by the reduction of "information float" a term coined by White and Dorman (2000) to define the time that information spends in the communication channels. Information float has been reduced from several days to seconds due to computer networks, and has resulted in much more information being sent at much faster speeds. Their study found that not only has production of printed materials and billboards increased, but more people are online, creating web pages, and placing more information on the Internet, thus increasing the potential for information overload. Information previously viewed as an asset, is now a potential liability for businesses and workers when individuals develop physical and mental symptoms due to overexposure to information. The study reiterated and expanded the

strategies of Shenk to reduce the effects of information overload, and to enable individuals to cope with vast amounts of information.

In a study analyzing the theory that information overload has a negative effect on performance, Kock (2000) surveyed twenty-two managers and determined that there was no direct correlation between information overload and task performance. The two factors from the study most affected by information overload were decision making ability and work expertise acquisition. The study found that individual factors more than task factors are affected by information overload and that the respondents perceived information overload to be related to the pressure of performing within a certain timeframe rather than the volume of information to be processed. The study also concluded that information overload has a potential positive effect on task performance up to an individual optimum level, by motivating individuals to prioritize work within time constraints, however, the individual's information overload threshold varies from person to person so it remains undefined. This study is interesting because it suggests that if one could determine their personal information overload threshold they could potentially utilize that information to enhance their task productivity. Kock suggested that future research should focus on information overload models that analyze different facets of the effects, both positive and negative, of information overload.

Information technology and control models, thus far, have not been able to contain or control the information bombardment resulting in information overload. As organizations rely more on information technology to store, retrieve, process, and manipulate information, the closer we are to the information saturation point. When

managers are expected to absorb information to make effective decisions they are potentially overwhelmed by the volume of information they receive on a daily basis.

The dilemma of managerial overload, that was created when corporations expected technology to improve manager productivity, quality of work life, decision-making skills, and the company's bottom line, was addressed by Farhoomed and Drury (2002). This study demonstrates that, in fact, the expectations of technology have not materialized in some cases, and with the production of expectations exceeding the human information saturation point, detrimental effects have occurred. Farhoomed and Drury found that workers are feeling stress, strain, and anxiety, and these factors are threatening worker productivity, and the adoption of new technology. They defined information overload as giving workers more information than they can absorb so that information is received more than is needed, or wanted, to function effectively and further the goals of the individual or organization. Information overload occurs when the information processing demand on an individual's time for performing actions, and calculations, exceeds the supply or capacity of time available for processing.

The most frequently cited reasons for managerial overload in the Farhoomed and Drury study were excessive volumes of information, difficulty or impossibility of managing it, irrelevance or unimportance of most of it, lack of time to understand it, and multiple sources of it. The study concluded that the new technologies in use today compound the problem of information saturation. The information flow has become simultaneous, multidirectional, and overwhelming. The Internet and e-mail were cited in this study as the main external sources of information influx. The effects of information overload included loss of time, negative effect on work, reduced efficiency, frustration,

tiredness, stress, negative effect on decision quality, reduction in productivity, negative effects on department or whole organization, and damage to personal life.

The negative effects of information overload from these studies can be equated to the detrimental effects created by substance abuse or poor mental health on the individual and those around them. The severity of this information saturation needs to be addressed systematically in order to deter the negative effects, enhance the positive effects, and to train managers and students to manage their time and information efficiently. Regardless of how information overload is created it affects individuals in two ways by causing an inability to locate what they need due to sheer volume, thus overlooking critical information, or by causing the individual to fail to use relevant information at hand or known to be available leading to the inefficient use of time. Information mismanagement can lead an individual to the information saturation point, which in turn, becomes detrimental to the organization. All of these studies have confirmed that information overload can cause detrimental effects to the physical and mental well being of individuals, and that information overload manifests itself in both business and human costs.

The researchers in these studies all agree on the basic definition of information overload and that it is a rapidly increasing problem due to the large amounts of information that humans are expected to absorb in a minimal amount of time. Analyzing techniques to control information mismanagement through proactive use is an area where research should be directed. This research would give individuals the tools needed to manage and prioritize information to increase their efficiency and effectiveness. Until this problem is addressed organizations will continue to experience a loss of human

capital and productivity due to the inability to absorb critical information for accurate decision-making. Since the human capacity for information absorption has not increased, methodology needs to be improved to organize and contain the influx before the information saturation point causes further inability to absorb relevant information. Areas of research in the social sciences, decision sciences, information sciences and time management techniques should be pursued to develop the discipline of Information Management. Information Management needs to address the problems of managing data flow within an organization, studying the information flow on organizational behavior, and determining the optimization of ranking, categorizing, and filtering information within the organization.

Many studies have been conducted to determine the extent of information overload in the managerial world, but few have been centered on the educational aspect of information overload. There seems to be an acceptance of information overload as it relates to academia, partially because students are expected to absorb a plethora of knowledge during their studies, and are continually bombarded by a multitude of sources of information. This acquisition of large amounts of information may be overwhelming the students and creating a situation where the students are reaching the point of diminishing return where the information is no longer beneficial and possibly detrimental to the learning process. Studies of the effect of information overload on university students should be conducted to attempt to understand the size of the problem, successful coping strategies, and to create a dam to stem the flow of the information waters. This research could empower students to harness the information influx prior to entering the

professional managerial ranks in order to minimize the detrimental health and psychological effects experienced by the managers in previous studies.

This information overload study was conducted to answer the following questions to determine if individuals experience information overload prior to entering the managerial ranks in the business world:

1. Do undergraduate students experience information overload, and if they do are they experiencing the same physical and emotional effects of the information overload maladies that were present for the business managers?
2. What is the frequency of the students' information overload?
3. When information overload is experienced do the students have sources and coping strategies that are unique to the students or comparable to the managers?
4. How does information overload affect the students' work?
5. How can university professors utilize this information to reduce the influx of information before it reaches the threshold with detrimental effects to student performance?

Methodology

The participants in this study were full-time undergraduate students from a small private southern university with a student population of 4,262 undergraduate students of which 61% were women, 39% were male, and 9.4% were minority. The students were enrolled in Introduction to Management Information Systems, the introductory course for both the Business Administration and Computer Information Systems majors. The class discussion during the study was centered on organization of information prior to their introduction to relational database management systems.

The students were asked to respond to the following open-ended questions presented in the class lecture that were originally derived for 124 managers in the study conducted by Farhoomed and Drury (2002).

The questions were as follows:

1. What does information overload mean to you?
2. How often do you experience it?
3. What are its primary sources?
4. In what ways does it affect your work?
5. When facing it what do you do to improve the situation?

The students responded to the questions as an in class assignment with instructions to answer them truthfully, and to place their answers into a document for electronic submission to their course management system digital drop box. There were no limitations on the length of their responses or any time constraints on their completion.

Results

The documents with the students' responses to the questions were retrieved from the digital drop box, and tagged for the following demographic characteristics: (1) age, (2) ethnicity, (3) gender, (4) class (freshman, sophomore, junior, or senior), and (5) academic major of the students. The responses were analyzed for the total participant population, and then analyzed by gender to determine any trends in the responses that could be attributed to gender. There were ninety-eight respondents total with a demographic breakdown as follows:

1. All respondents were 18 to 22 years of age.
2. Respondents were: 94.90% Caucasian, 3.06% African American, 2.04% Hispanic
3. Respondents were: 30.67% Females, 61.22% Males
4. Respondents were: 72.45% Freshmen, 17.35% Sophomores, 9.18% Juniors, 1.02% Seniors
5. Respondents were: 76.53% Business majors, 4.08% Accounting majors, 1.02% Finance Majors, 3.06% Corporate Communications majors, 4.08% Computer Information Systems majors, 1.02% Computer Science majors, 1.02% Exercise and Sports Medicine majors, 1.02% Leisure Sports Management majors, 1.02% Spanish majors, and 7.14% Undecided majors

Since the majority of the students were Caucasian, Business Majors, and in the freshman academic class, there was not enough diversity within the participant

population subgroups to analyze any significant differences between demographic groups other than gender.

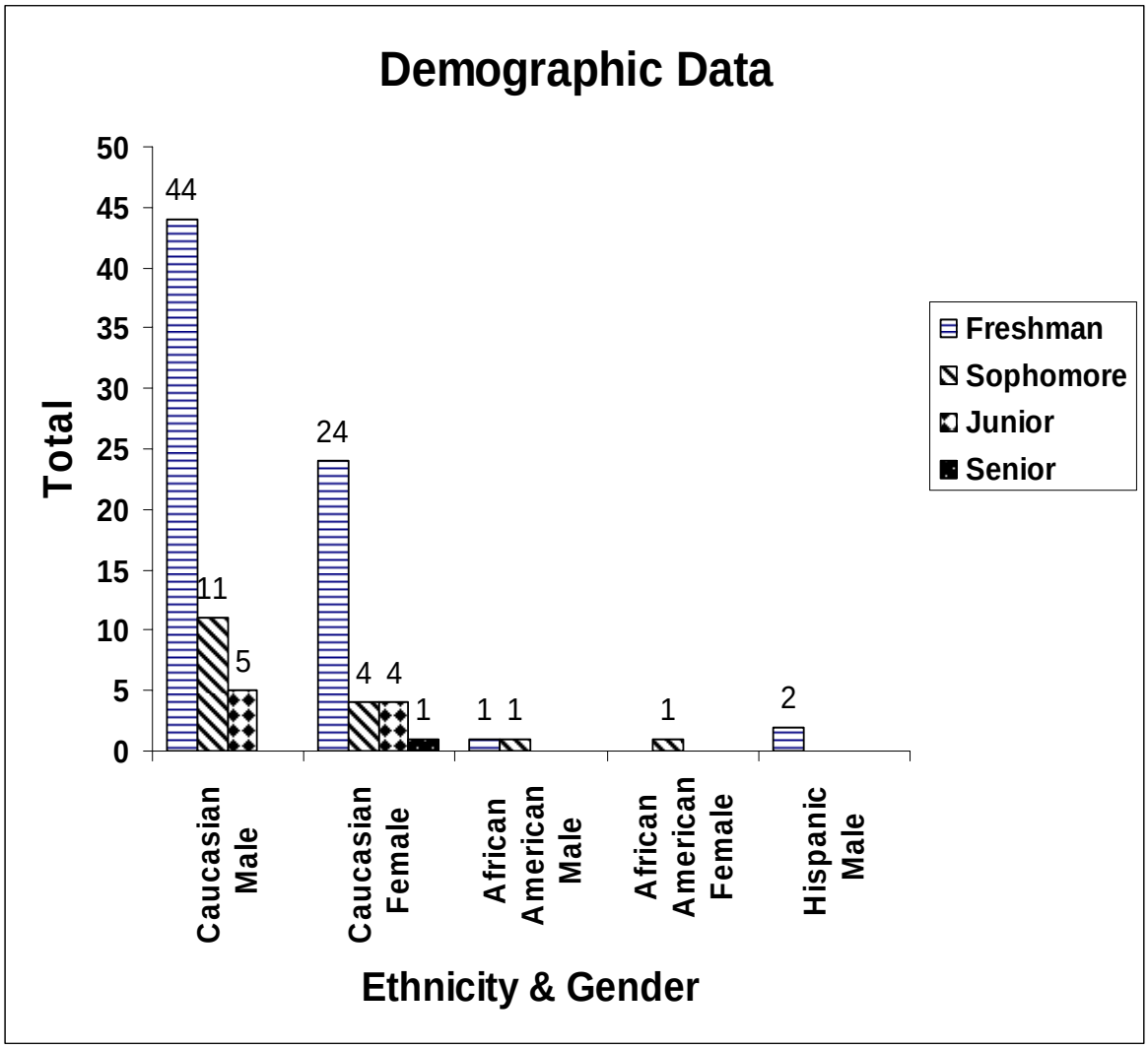

Fig. 1. Ethnicity, gender, and university class for total population.

The components of the definition of information overload were divided into four major categories: Volume, Time Constraints, Irrelevance, and Multiple Sources. The categories for the components were derived from the Farhoomed and Drury (2002) study. The number of times the students mentioned each category was plotted to determine their components of the definition of information overload.

The components were plotted on a line-column chart for comparison of results.

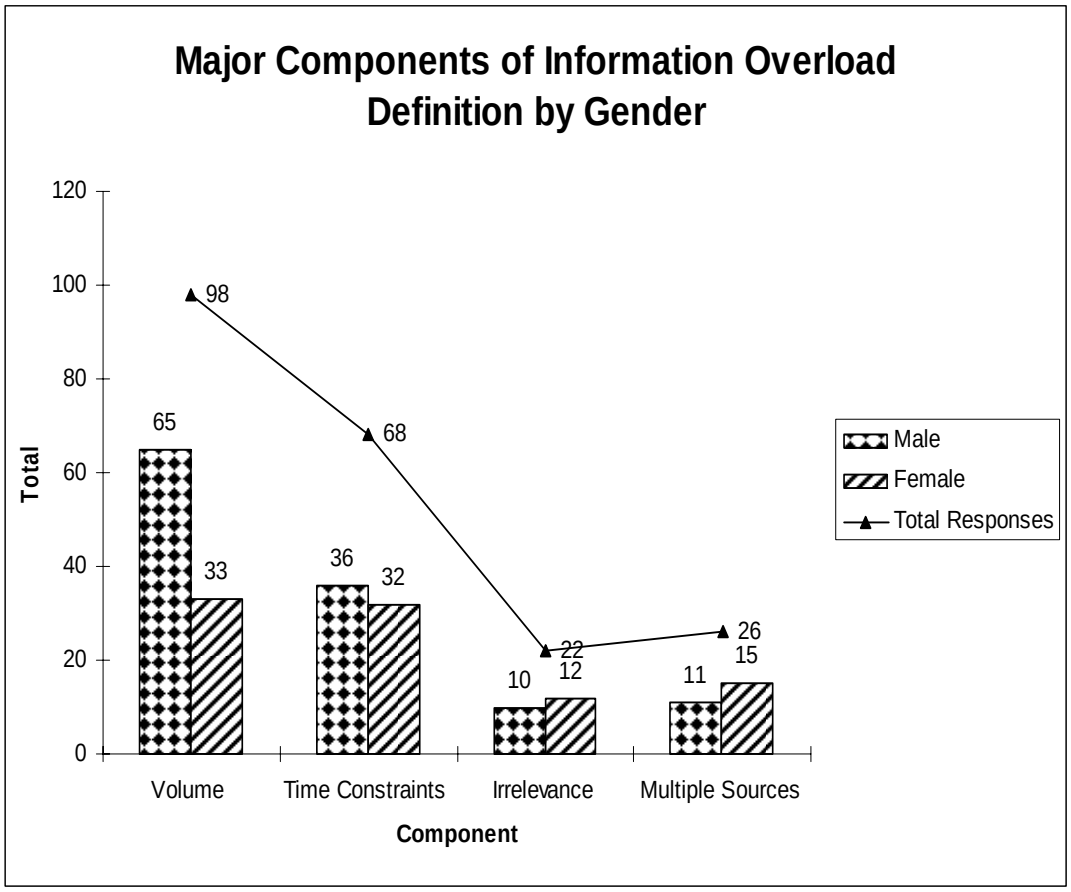

Fig. 2. Major components of information overload for total population by gender.

The frequency of when the students experienced information overload was divided into the following categories: (1) Everyday, (2) Often, (3) Sometimes, (4) Seldom. These categories were modified from the Farhoomed and Drury (2002) study and derived from the students' responses to question two.

The frequency was plotted on a bar chart for comparison.

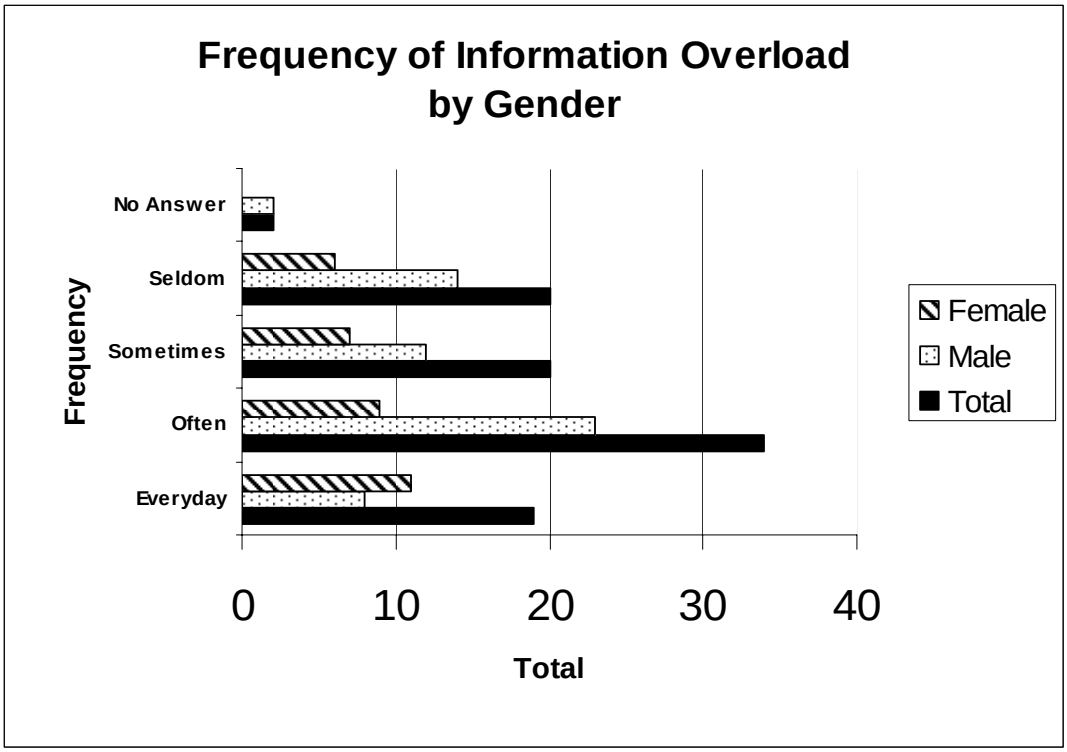

Fig. 3. Frequency of information overload for total population and by gender.

The primary sources categories were developed from the students' responses to question three, because the primary sources were different than those derived from the managers surveyed in the Farhoomed and Drury (2002) study. After analyzing the students' responses the primary sources were placed in the following categories: (1) Telephone, (2) Web/Internet, (3) E-mail, (4) University Classes, (5) Work, (6) Self, (7) IM/Friends/Family.

The frequency of the primary sources was plotted on a bar chart for comparison of results.

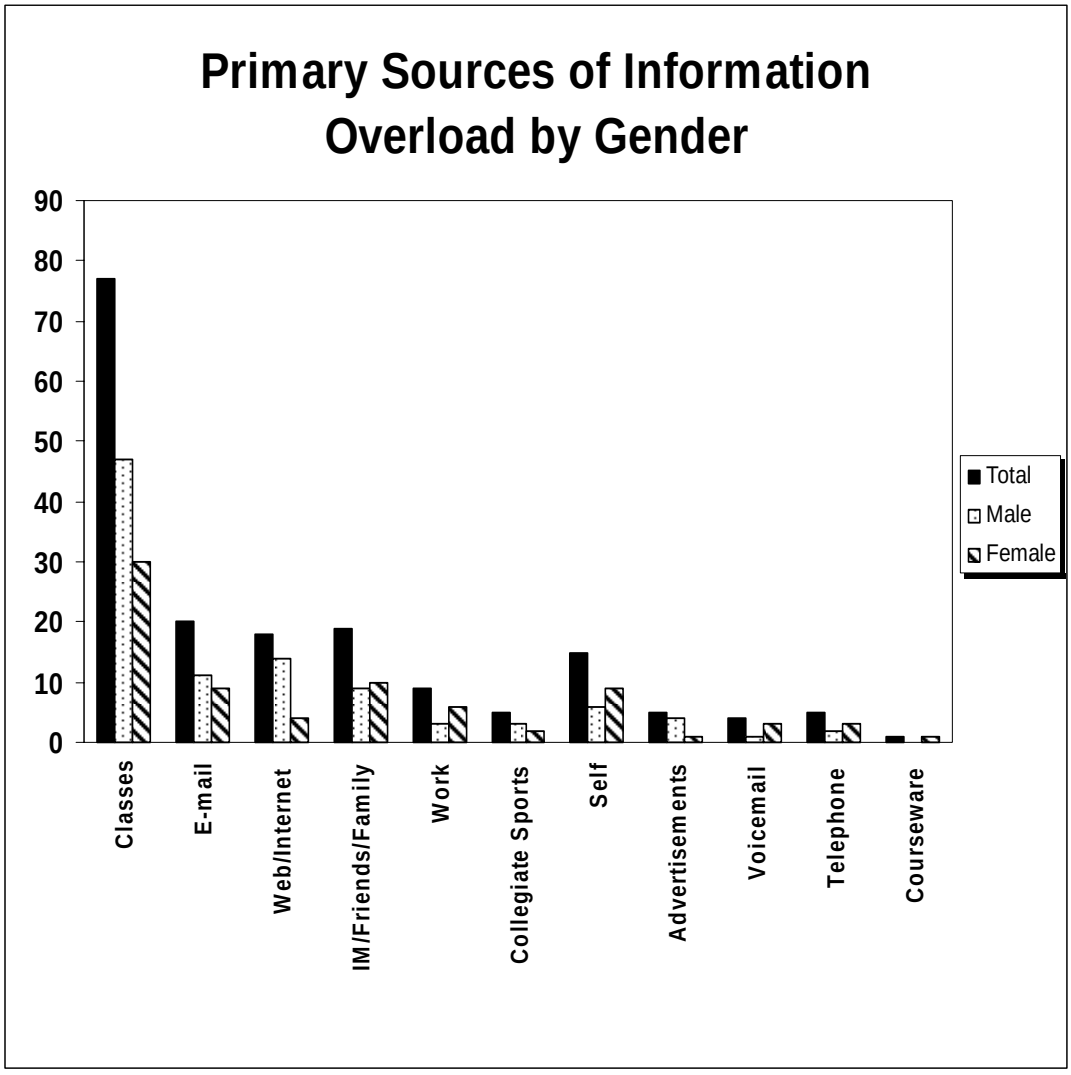

Fig. 4. Primary sources of information overload for total population and by gender.

The effect of information overload on work was divided into the following categories: (1) Negative effect on quality of class work, (2) Frustration/Tired/Stressed, (3) Loss of Time, (4) Reduced Efficiency, (5) Reduced Productivity, (6) Negative Effect on Decision Quality, (7) No Effect.

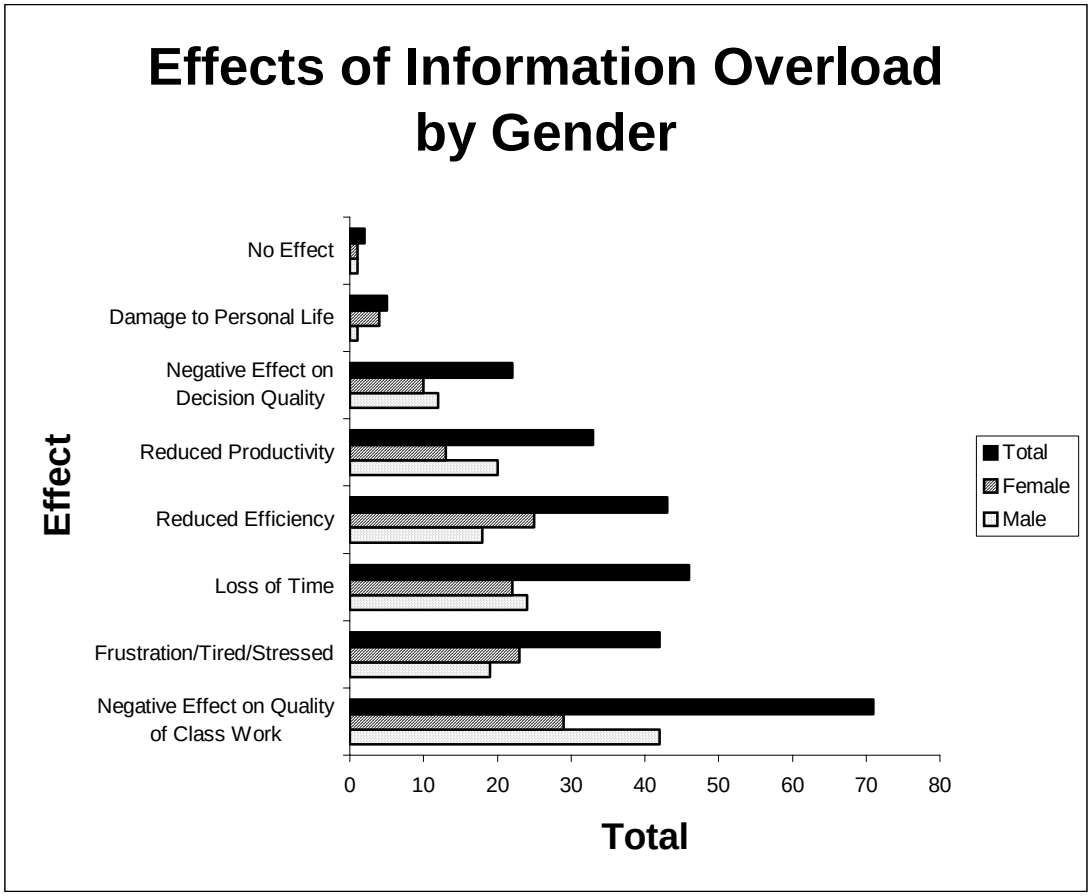

Fig. 5. Effects of information overload for total population and by gender.

The coping strategies were divided into three major categories: P-Personal, T-Technology, and I-Ignore. These major categories were identical to the coping strategies categories utilized by Farhoomed and Drury (2002). However the subcategories for the students' coping strategies were different because they were derived from the open-ended responses to question five.

From the three major categories the additional student subcategories were defined as follows:

Personal	Technology	Ignore
P1-Filtering Information	T1-Utilize Technology	I1-Ignore Information
P2-Eliminate the Source		
P3-Take a Break		
P4-Prioritize Information		
P5-Organize Work		
P6-Delegate Work		
P7-Do Nothing		
P8-Freak Out		

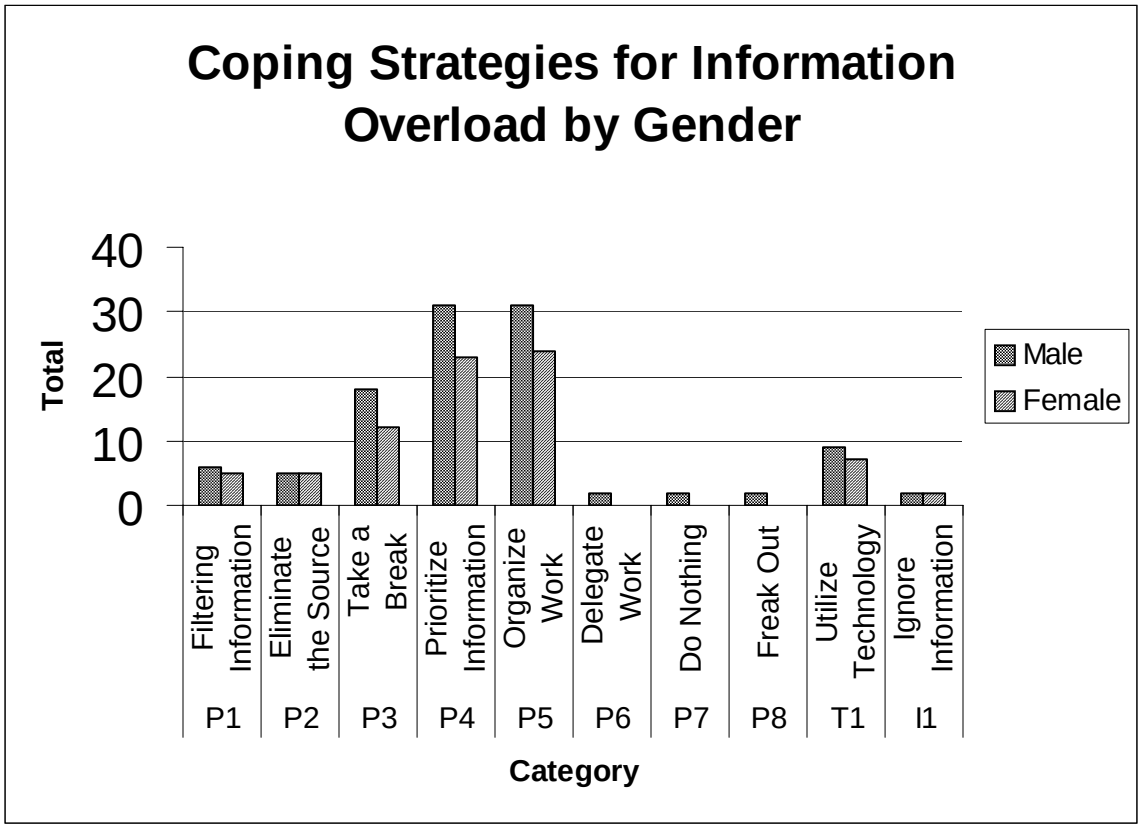

Fig. 6. Coping strategies for information overload by gender.

Discussion of Results

The study results demonstrate that within this sample population of 98 full-time undergraduate students, volume and time constraints are the terms cited most often within their definition of information overload. 100% of the students mentioned volume in their definition of information overload. The majority of the students experience information overload often, followed by sometimes, seldom, and everyday. There were no students that responded that they never experienced information overload. The primary sources of information overload for the students are class work, e-mail, instant messaging, friends, family, Web and Internet. The effects that the students experienced from information overload are negative effects on the quality of class work, followed by loss of time, reduced efficiency, frustration/tired/stressed feelings, and reduced productivity. Only one student responded that information overload had no effect. The coping strategies used most often by the students are to organize information, prioritize information, take a break or utilize technology.

The results analyzed by gender, indicate only minimal differences between the overall results and the gender based results in the definition components of information overload. The most significant difference was that 45.45% of the female students mentioned multiple sources in their definition compared to 16.92% of the male students. The primary sources of information overload indicate a gender difference where a larger percentage of the male students mentioned the Web and

Internet as primary sources in their responses than the female students, and a larger percentage of the female students mentioned classes, and self as primary sources than the male students.

More female students than male students stated that they experienced information overload everyday. Both the male and female students cited negative effect on quality of class work most often as the main effect of information overload. The gender based analysis also indicates that both the male and female students were more likely to use the coping strategies of prioritizing information and organizing work to reduce the information overload effect.

The students utilized many coping strategies and methods to decrease the effects of information overload. The majority of both male and female students utilized the strategies of prioritizing work, organizing work and taking a break when coping with information overload. However, male students only used the strategies of delegating work, doing nothing and freaking out.

Recommendations and Conclusions

This study indicates that the population of ninety-eight full-time undergraduate students do experience information overload, and that information overload can adversely affect the quality if their class work, including their efficiency, decision-making and productivity. Many of their responses contained emotional content which may be attributed to the majority of the respondents being first year students who are having to adjust to living away from home, university class schedules, course workloads and prioritizing time, that are contributing to their physical and psychological stress.

This type of study is not conducive to establishing cause and effect relationships. Further studies that utilize a longitudinal study design and include more academic majors should be undertaken to quantify the effects of information overload on university students. This type of research would be beneficial to develop effective coping strategies to assist in minimizing the negative effect on class work, frustration/tired/stressed feelings, loss of time, reduction in decision quality and lower productivity experienced by the students.

This study was however beneficial to me as the students' instructor by providing me with insight into the difficulties that these students were experiencing at that point in their lives so I could minimize my direct contribution to their information overload. Several of my suggestions for minimizing information overload for full-time undergraduate university students can be directly derived from the student responses.

Classes were mentioned by 78.57% of the students as their primary source of information overload, this is consistent with the findings of the managerial study where 60% of the managers cited internal sources of information overload. Classes cited by the students as the primary source of information overload parallels the managers citing internal organizational sources for information overload. The students were very specific in their responses for primary sources, citing cumulative tests, school work, lecture notes, reading material, concepts that are hard to comprehend, overloaded schedules, homework, assignments, exams, presentations, and reports. As their instructor I realized the importance of using the courseware offered by the university to place all of the information they needed in one location and evaluating my syllabus for due dates, difficulty and number of assignments.

The frequency of the experience of information overload most cited for the managers was everyday. The student responses cited often as the highest information overload frequency interval, while detailing what caused them to experience the information overload in their responses. The students in this sample population cited professors, classes, events, collegiate sports, organizations, e-mail, major exams, jobs, being emotionally drained, sorority and fraternity activities, midterms, finals, when major projects are due, many assignments at one time, and web sites as contributing to information overload in their responses. All of these experiences can be minimized either by the student or the professor, or both by developing methodologies or strategies for dealing with the information influx to decrease the loss of productivity.

University professors can implement techniques to minimize the frequency of information overload experienced by their students, and modify their behavior to improve the situation for students by developing information reduction strategies. These reduction strategies could include earmarking areas where information overload can be reduced in the classroom for example:

1. Distributing difficult assignments and exams evenly over the semester.
2. Adjusting midterm exam schedules to not directly coincide with midterm week.
3. Limiting the amount of e-mails sent to students.
4. Defining clearly items for assignments and exams so that students will not study the wrong or unnecessary information.
5. Placing all the course material on a course web site where the students only have one place they need to go to find their class information.

Further studies should be conducted to increase awareness of information overload in higher educational organizations, and to instruct students on strategies to minimize information overload in their class work. These strategies should focus on addressing the problems of managing data flow, studying the effects of information flow on behavior, and determining the optimization of ranking, categorizing, and filtering information to minimize information overload for the students. In addition further studies should address the use of courseware, class listservs, discussion

boards, chat rooms, blogs, online courses and distance education to develop techniques to minimize information overload. Only when individuals and organizations make a concerted effort and take a proactive stance to minimize the occurrences of information overload, will the detrimental effects of information overload be reduced.

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