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RIGOR AND RELEVANCE: THE APPLICATION OF THE CRITICAL INCIDENT TECHNIQUE TO INVESTIGATE EMAIL USAGE

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Information systems research is often criticized for its high rigor, but low relevance. One approach to overcome the low relevance issue is to employ sound qualitative methods, out of which this study focuses on the critical incident technique (CIT) that has mostly been overlooked in IS research. The primary goal of this study is to demonstrate and validate the usage of the critical incident technique in the management information systems domain. The secondary objective is to develop a number of practical recommendations for email service providers and to offer novel theoretical insights that may be employed in future research. To this end, 107 positive and 113 negative critical incidents pertaining to email usage were collected and analyzed through classical content analysis techniques. Overall, this investigation validates the usage of the CIT in the MIS field and presents practical and theoretical recommendations.

Keywords: ***critical incident technique; email; user survey***

1. INTRODUCTION

At a recent management information systems (MIS) conference, a discussant stated:

> *Assume that a researcher studied the employment of an information system in a company by using TAM [Technology Acceptance Model] and told the IT manager: "In order to be utilized, the system should be useful and easy to use." The manager's answer is likely going to be "Duh!"*

In fact, a number of academics have emphasized that many MIS and IT research projects do not address the needs of practitioners [1–5]. This gap between research and practice has also received empirical support. For example, a survey of IS professionals revealed that most of them are unaware of academic work and feel that scholarly articles are outdated, difficult to read, and of little value [6]. Currently, IS practitioners rarely participate in academic conferences [7]. Similar arguments have been made in

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other business fields, for example, marketing [8], strategic management [9–11], knowledge management [12], and international business [13].

In order to engage in high-quality scholarly investigation and address the needs of practitioners, action research was suggested as a fruitful inquiry method [14]. This method has become popular, as evidenced by the increasing number of action research publications. At the same time, the critical incident technique (CIT) may also enable researchers to maintain scientific rigor while meeting the interests of practitioners in applied settings. To date, this method has been underemployed in MIS. The CIT was developed to help professionals design and test various technologies [15]. Its application may also contribute to theory by uncovering certain phenomena, which other inquiry methods may miss [16, 17]. However, the validity of employing the CIT should be further demonstrated, and more examples of its usage in MIS projects are needed.

The key objective of this study is to demonstrate the application of the CIT in MIS research so that it provides a spring-board for future CIT studies. The secondary goal is to develop a number of practical and theoretical recommendations. The applied suggestions are targeted to practitioners, such as email service providers. The theoretical insights that emerge through the application of the CIT often help to uncover new facts, issues, and phenomena that are of interest to the academic community and may be developed in future research.

This investigation focuses on electronic mail as the IT artifact. Email has become one of the major communications media of the 21st century. It is often described as a *killer* and even as a *serial-killer* application of both telecommunications systems and the Internet [18, 19]. Email was originally developed as a simple communication application, but is now used for additional functions. For example, it assists users in information management, task coordination, document archiving, file storage, and collaboration. Some email applications serve as personal information management tools by providing integrated solutions for managing digital communication and daily activities. While the benefits of using email are unarguable, many email users have experienced a number of negative consequences, such as excessive workload, personality changes, and even addictive disorders [20].

Currently, individuals and organizations of all forms utilize email. Although its use is fairly universal, it is not viable to study email usage by all categories of users in a single project due to the dramatic differences in tasks, personal user characteristics, and usage policies. In the present investigation, the use of email by university students was chosen for two reasons. First, the level of satisfaction with email services of university students is dramatically lower than their degree of satisfaction with other services, including phone and e-commerce [21]. Overall, university students are somewhat dissatisfied with their email experience. Second, anecdotal evidence suggests that students ignore university-based email accounts. They experience problems with their email, such as spam, lost messages, or various usability issues.

Although the current situation with the employment of email by university students is not critical, email providers may be eager to learn more about the situation from the user perspective. It may be particularly important to know about positive and negative critical situations that users experience interacting with their email. The application of the CIT, described in the next section, is an effective way to achieve this understanding.

It is noted that the nature of the theoretical contributions of this study somewhat differs from those of traditional MIS investigations. There are no theory-based

research questions or other theoretical underpinnings to build strong arguments to be tested empirically. Instead, this project explores the potential value of the CIT in the MIS field as a tool for developing practical recommendations and discovering new phenomena. To confirm the practical recommendations, the findings were reported to university officials responsible for the development, administration, and supervision of email initiatives. Their feedback is presented in the paper. To highlight the importance and novelty of theoretical insights, this project's findings were compared with those of prior TAM-based investigations reported in the extant literature. It was demonstrated that some of the previously known phenomena were confirmed, whereas some novel issues appeared.

2. THE CRITICAL INCIDENT TECHNIQUE OVERVIEW AND PROJECT METHODOLOGY

The critical incident technique, which evolved naturally from work in the Aviation Psychology Program of the United States Air Force, was best documented in Colonel John C. Flanagan's[1] [15] initial article published in *Psychology Bulletin*. The CIT is a flexible set of guidelines for collecting significant facts regarding behavior in specific situations. Its goal is to facilitate the application of received information to address practical problems and develop broad psychological principles. An incident is "any observable human activity that is sufficiently complete in itself to permit inferences and predictions to be made about the person performing the act" [15, p. 327] that has a high degree of significance for a person's task success or failure [22]. The CIT assumes that people may accurately report critical incidents on their own [23, 24]. Therefore, researchers may ask respondents to provide brief factual reports on their actions, feelings, and behavioral changes in response to critical situations. An incident is positive if it helped somebody solve a problem, or negative if the solution failed, caused new problems, or facilitated additional actions. In the present study, the objective is to document and analyze scenarios of email usage in positive and negative critical incidents to understand user behavior and incident causes. Positive and negative incidents that individuals experience with information technologies affect different types of user perceptions and cause opposite technology adoption decisions [25]. Therefore, depending on the nature of an incident, some critical differences in user actions, feelings, and behavioral changes may exist.

The CIT has been applied in several management fields, such as organizational behavior, human resources, and marketing [26–30]. It has been also employed in several IS projects [31–34]. At the same time, except for a few notable [35–37], CIT papers are still rare in leading MIS and IT journals.

Similar to other qualitative methods, the CIT has both strengths and weaknesses [16, 38]. In terms of its strengths, first, it allows researchers to minimize their bias because respondents decide what incidents are the most relevant. Second, the research process is inductive; it may generate the novel descriptions of previously undocumented phenomena, conceptual structures, and research questions that may be tested in the future. Third, it offers rich data of firsthand experience that may be used to

[1] John C. Flanagan is the founder of the American Institutes for Research, a not-for-profit organization dedicated to the study of human resources and their effective use.

understand behavior. With respect to its weaknesses, validity and reliability are major concerns. First, researchers may misunderstand and misinterpret people's stories. Second, during data analysis, ambiguity with regards to categories and codes may arise, and it will be impossible to ask for clarifications. Third, because the CIT is retrospective, data validity may be affected by recall bias because respondents may forget important details.

Despite these shortcomings, the CIT is generally referred to as a sound methodology offering reliable, valid, and generalizable results [22, 38, 39]. Both interviews and self-administered questionnaires produce the same results as long as the respondents are motivated to read the instructions and answer conscientiously [15, 40]. In terms of sample sizes, most studies examined 50 to 100 incidents and only a few included more than 300 cases [41, 42]. Therefore, obtaining around 200 incidents (i.e., 100 positive and 100 negative) may provide a sufficient level of theoretical saturation in the present project.

The CIT may also be applied for service research [16, 43], and because email is a service, it is a potentially fruitful method of inquiry in the present investigation. Initially, the technique was designed to address practical problems, but it may also be useful in theory development, because it may uncover new phenomena missed by scholars who employed different methodologies [17, 29]. The present study will not only identify a number of practical recommendations but also help to uncover new phenomena relating to the way people interact with their email systems. The exploratory nature of this project intends to facilitate future theory building by confirming facts and offering novel implications.

In this project, a paper-based self-administered survey of students of two Canadian universities was conducted. Both universities had their own proprietary email systems, but students were allowed to use any email accounts. Based on the CIT instruments from previous studies [40, 44], a survey instrument was constructed. The participants were provided with definitions of email and critical incidents and were asked to offer one or two positive and one or two negative critical incidents that occurred when they employed any email application in any setting. The following questions were asked: (1) name of an email system; (2) complete and detailed description of this incident; (3) when it took place; (4) feelings and perceptions of this situation; (5) actions taken during the incident; (6) any possible changes in the way subjects used this email system after the incident; and (7) frequency of the incident occurrence. The order of positive and negative situations was randomized to avoid order bias.

Potential CIT weaknesses were mitigated to improve reliability, validity, and generalizability. First, two independent coders were used to improve the validity and reliability of coding. Inter-coder reliability was assessed by measuring their level of agreement. Intra-coder reliability was measured by re-coding 30% of randomly selected incidents six months after the first round of coding. Second, draft a priori categories for a preliminary codebook were developed based on the MIS and HCI literature [45]. A priori codes and their descriptions were derived from email-related publications. If a new code was required during coding, it was discussed by the research team and was selected based on the literature. Third, at least one investigator familiar with the local usage of email at each site participated in the coding process. Fourth, participants were presented with detailed instructions pertaining to various aspects of an incident to facilitate recall. Fifth, to improve generalizability, two

investigation sites were selected. One hundred undergraduate and graduate students were randomly approached, and 71 usable questionnaires were returned and used for analysis. Almost the same number of questionnaires was collected at both universities.

3. DATA ANALYSIS AND RESULTS

3.1 Descriptive Statistics

The average age of respondents was 27 years old, ranging from 19 to 50 years. Twenty percent were female. Two hundred and twenty incidents were provided, 107 positive and 113 negative. Every incident was analyzed along the following dimensions: (1) incident cause; (2) user feelings or perceptions; (3) user actions; and (4) future behavior change. Positive and negative incidents were analyzed separately by two independent coders who used the same codebook. The coders achieved an acceptable level of inter-rater agreement (i.e., the Krippendorff's [46] coefficient was above 0.8). To assess intra-rater reliability, each coder repeatedly coded 30% of randomly selected incidents six months after the initial round of coding and achieved 100% accuracy. The positivist paradigm was followed [47, 48], and classical content analysis procedures were employed [49–52]. All discrepancies were discussed by the coders in person until agreement on the most appropriate item classification was reached.

Fifty-three percent of respondents offered incidents relating to two different email systems, 24% mentioned one, 20% three, and 3% four systems. Therefore, more than 75% of all subjects simultaneously utilized more than one email application. This is consistent with anecdotal evidence that most university students have multiple email accounts. Figure 1 presents email applications employed by the subjects. Online interface of Hotmail was the primary one (30%), followed by MS Outlook (17%), and online interface of Yahoo! (16%). At the same time, university-based emails in forms of online interfaces were reported in only 16% of all cases.

3.2 Positive Critical Incidents Analysis

Regarding the positive incident cause, 28 distinct categories appeared (see Figure 2). All users expressed positive feelings toward positive events; for example, comfortability, satisfaction, pleasure, and happiness. They were impressed with service improvements,

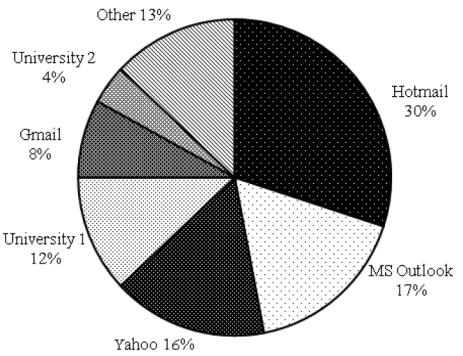

Figure 1 Email systems.

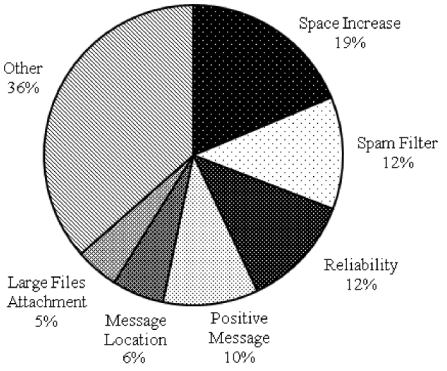

Figure 2 Positive critical incident—cause.

perceived a higher degree of ease of use of their email, and believed that the provider attempted to meet customers' expectations. During positive incidents, 85% of the respondents indicated they immediately used the function or information to complete work, 6% followed the system's recommendation, one person explored new features of an email client, and 7% took no action.

Figure 3 outlines future changes in user behavior as a result of positive incidents. Based on the findings, 37% of the users did not alter their behavior, 36% stated they started employing the same feature constantly, 16% switched from one email system to another permanently or for particular tasks, and 4% began constantly learning how to more effectively utilize the email system. Several individuals reported that they increased their email efficiency or exhibited a higher degree of loyalty to the email system, promoting it to their peers.

3.2.1 Timeline and frequency. It was found that 18% of positive incidents took place today or during the last usage episode, 15% within the last week, 20% within the last month, 39% within the last year, and 9% over one year ago. In terms of frequency, 31% of the reported incidents occurred during every system usage, 9% daily, 13% weekly, 7% monthly, 17% yearly, and 23% only once.

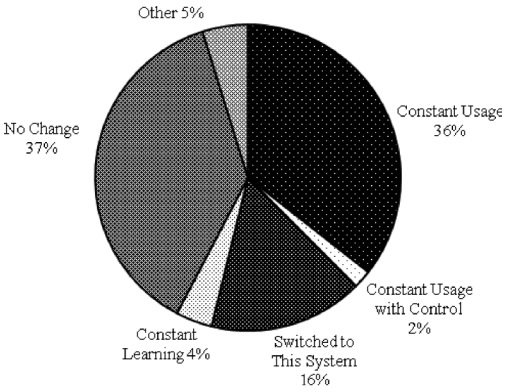

Figure 3 Positive critical incident—behavior change.

3.2.2 Space limit increase. The major category of incident causes took place when Hotmail, Yahoo!, and Gmail increased their mailbox size (19%). This change allowed users to receive larger files, keep more messages online, or better utilize email as a storage place. A majority of all space limit increase incidents occurred within the last year and took place either once or yearly. For example:

> *"Hotmail was trying to compete with GMail and increased their mail box sizes making it easier to keep pictures, large documents and more emails in your mail box longer."*
>
> *"Hotmail issued more MB limits than the university e-mail. Thus I could use Hotmail for receiving e-mails with large attachments, and not be over-capacity."*

All respondents indicated that they were very satisfied with this experience and felt happy about their future email usage. Many started immediately using extra space, made this system their primary email account and planned to continue doing so in the future. Space increase also prevented some individuals from switching to another email system:

> *"I was going to switch [from Hotmail] because my inbox was always full and needing things deleted, but now I could keep my account."*

3.2.3 Spam filter. The second incident cause category (12%) pertained to spam filters that identified and removed unsolicited commercials, phishing (an attempt to acquire personal information through sender misrepresentation), or dangerous messages. In contrast to the category above, most spam filter events occurred recently and were repeated daily or weekly:

> *"Spam filter caught a phishing email targeted at EBay sellers such as myself."*
>
> *"I registered in a commercial website. After that my Hotmail received 10 junk emails every day. I applied the anti-junk mail function. Then it helped to block most of the junk mails."*

Over half of the incidents were reported by Hotmail users who appreciated this type of assistance and followed the recommendation of the system to ignore unsolicited messages:

> *"Although I would recognize the fake message, it is comforting that there is some barrier."*

In the future, most people intended to continue employing anti-spam functions in their email system. At the same time, a few users stated that even though they apply a spam filter, they still control the performance of the software to make sure no real messages get accidentally deleted:

> *"I still check my junk mail folder to make sure that no real e-mail gets put there."*

3.2.4 Email reliability. The third category (12%) related to general reliability of various email applications. Users indicated that their email delivered an important message in a timely manner. In fact, it is the major purpose of an email system to deliver messages within a short time period, ranging from several seconds to a few

minutes. In terms of responses, two indicators identifying this category were present: (1) message delivery (i.e., the message was actually delivered in the same form it was sent) and (2) it was done very quickly. Almost all of these incidents took place and re-occurred during the last episode of email usage.

"Timely and reliable delivery of a message to my father."

All users were satisfied with email reliability and believed they could rely on this medium. They carried on their regular email activities with no future behavior changes.

"I was happy that my emails were sent reliably. . . . I sent my email and felt good knowing it would reach its final destination."

3.2.5 Positive message. In the fourth category (10%), respondents described an incident when they received an important positive message and associated the receipt of this message with the email system delivering it. As a result, people expressed positive feelings toward not only the message but also toward the entire email application; they continued using their email in the same way as before and did not change their future usage behavior. Most incidents happened one year ago or later and repeated infrequently. The cases related to various systems. The discussion section offers a detailed analysis of this phenomenon by employing psychology literature.

"I got a birthday message when I was alone. I felt connected."
"[I] received an email containing a gift certificate for a retail store. I felt happy and surprised."

3.2.6 Message location. The fifth category (6%) pertained to an incident in which people were able to efficiently locate a message sent or received in the past. For this, they employed search or sort functions in their inbox or other folders including the "sent items." Particularly, several individuals mentioned automatic message saving facilities that helped them find a sent message:

"University mail saves all sent messages, so once I sent an important email with attachments to myself and I wrote in the wrong address by accident. I was lucky to find it in my 'sent' folder. I was very happy and relieved that I didn't lose my work."

No particular timeliness or occurrence frequency pattern was observed. After the incident, some users started employing that system to a greater extent, for instance:

"I tend to send important files over my university account."

3.2.7 Large file attachment. The possibility to attach large files (5%) was the sixth category. Users presented an incident when they were able to successfully send a very large file or a high number of files in a single message not usually allowed by other email applications. These incidents took place over a month or year ago and repeated

very infrequently. In addition to positive feelings after the incident, some users began to always employ that email system for sending attachments:

> *"I needed to send a large file to a fellow student and my university account would not allow this. So, I used my personal Hotmail account instead. I was very happy that I had found a solution to my problem. Now I prefer to use Hotmail to send large files."*

3.2.8 Other category. Thirty-six percent of the incidents were reported by only a few individuals, and no significant category emerged. Nevertheless, some incidents deserve attention. First, users mentioned successful employment of various front-end interface features of their email applications, for example, an address book, message formatting options including font and graphics, spell check, automatic message processing rules, etc. Second, in one specific incident, a user mentioned a built-in intelligence feature of Pegasus Mail that automatically discovered that the user forgot to attach the file he/she intended to send with the message:

> *"[I] wrote a message to a colleague, indicating that a file was attached. I had forgotten to attach the file but put the word 'attached' in the email. Before the message got sent, it prompted me regarding whether I had intended to attach a file. I was very happy and pleased that [the] system addressed my error."*

Third, other respondents reported that the email system stopped using popup windows with unsolicited ads, allowed automatic upgrades, facilitated the transfer of messages from one email client to another, or received a notification about the current state of a recently sent message. Individuals expressed positive feelings and either did not change their future behavior or increased the employment of specific features or the entire system. No timeliness or frequency pattern for the "other" category emerged. Table 1 summarizes the findings.

Table 1 Summary of positive critical incidents.

Incident cause	Timeliness	Frequency	Feelings	Immediate actions	Future behavior change
Space limit increase (19%)	Long-term	Once or yearly	Positive	Employed the feature	Increased usage, higher loyalty
Spam filter (12%)	Short-term	Daily or weekly	Positive	Followed the recommendations	Continued usage, some control the filter performance
Reliability (12%)	Short-term	Every usage episode	Positive	Regular email activities	None
Positive message (10%)	Long-term	Once or yearly	Positive	Regular email activities	None
Message location (6%)	No pattern	No pattern	Positive	Employed the function	Some increased usage
Large file attachment (5%)	Medium-and-long-term	Monthly or yearly	Positive	Employed the function	Some increased usage

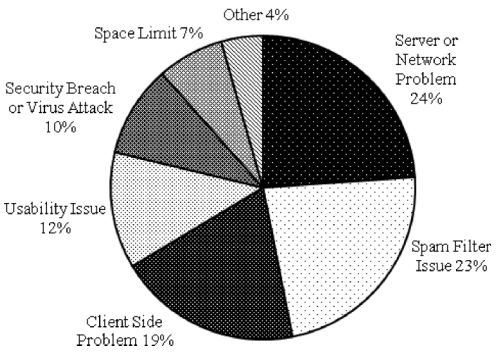

Figure 4 Negative critical incident—cause.

3.3 Negative Critical Incidents Analysis

In terms of negative incident causes, six major categories were identified (see Figure 4). User feelings were very negative; in 74% of the cases, people felt dissatisfied, frustrated, upset, or disappointed. In 19%, they were extremely angry or mad about what happened, and in a few incidents they were scared or humiliated. Figure 5 and Figure 6 outline user actions during the incident and future behavior changes respectively. It is noted that 60% of those who tried to fix the problem succeeded and 40% failed.

3.3.1 Timeline and frequency. The findings indicate that 10% of negative incidents took place today or during the last system usage episode, 14% within the last week, 24% within the last month, 41% within the last year, and 12% more than a year ago. Overall, this timeline was somewhat similar to that of positive incidents. With regards to the frequency of occurrence, 19% of negative incidents took place every system usage episode, 5% daily, 16% weekly, 21% monthly, 8% yearly, and 32% only once. This shows that negative incidents occur less frequently than positive ones.

3.3.2 Server- or network-side problem. This first category was mentioned in 24% of all negative incidents. During the incidents, the email system was down (i.e.,

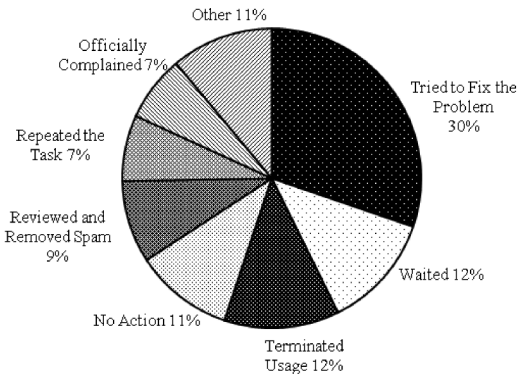

Figure 5 Negative critical incident—actions during the incident.

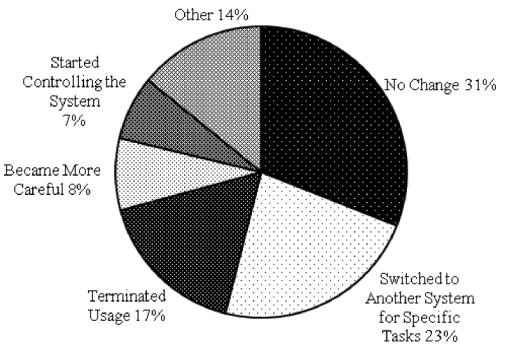

Figure 6 Negative critical incident—behavior change.

completely inaccessible) (14%), extremely slow in terms of message delivery (6%), or did not deliver a message (i.e., a message was sent but never arrived) (4%). The majority of all incidents were reported with the university-based accounts, followed by Hotmail and Yahoo!, took place one month ago or earlier, and repeated at least monthly. During the incident, most users simply waited, repeated, or abandoned the task. Some also officially complained to the service provider. A few tried to fix the problem or employed an alternative communications channel. Half of them did not alter their future behaviors; others switched to another email for most tasks even though they did not abandon their previous account:

> *"The [Gmail] server was unavailable yesterday for 5 mins to send/receive mail or access the account. I slapped the mouse on [the] desk, let out [a] big sigh, waited."*
>
> *"The [Hotmail] email took long time to go through. I was supposed to do a presentation using the files attached and was delayed several minutes due to a lack of 'instant' transfer. I apologized to the class while continuing to hit 'refresh'."*
>
> *"I tried to send an email to a classmate and it did not work. My friend never received it. I reported the incident to the computer services desk. [In future,] I ensured that when an email was important I used a different system."*

3.3.3 Spam filter issue. Incidents relating to the performance of a spam filter comprised 23% of all negative cases. Two types of incidents were reported: (1) false positives that were legitimate messages mistakenly classified as spam and moved to the junk folder (5%) and (2) false negatives that were unsolicited messages not caught by a spam filter (18%). Most cases of false positives occurred with Hotmail and Yahoo! relatively recently but were repeated rarely. During the false positives incident, when the terrified users discovered the problem, they had to manually review the junk mailbox and classify the message as a legitimate one. One person stopped using that system and the others started constantly reviewing the contents of the spam folder after the incident:

> *"A company that I needed a reply from's email went straight to my SPAM folder. I was mad that Yahoo! sent this email to my SPAM folder. I had to go to the options to say that emails from this company are NOT spam. I now have to regularly check my SPAM folder to see if my emails have ended up there."*

In contrast to false positives, most false negative incidents occurred not only with Hotmail and Yahoo! but also with other systems. They took place a long time ago but repeated frequently. Most people manually reviewed and removed all spam messages, some tried to block spammers, several terminated the usage of that email, and a few sent an official complaint to the provider. One-third of them did not change their future email usage pattern, one-fifth stopped using the system, and one-seventh permanently switched to another email. Others became more careful handling their email address, for example, they never released it online. In fact, it looked like there was little they could do to alleviate the problem:

"About a year ago I put my email address on the off-campus housing roommate listing—ever since I receive spam. I tried replying to not to send any more spam. [I] don't give my address out anymore."

"Suddenly I got thousands of spamming emails in just several days. I blocked those email senders . . . but it did not work well because Yahoo! just allowed 100 blocks. Finally, I discarded that email account which I had used for years."

3.3.4 Client-side problem. Negative events, which took place when something went wrong with the email client or the online email interface, were reported in 19% of all cases. Most of these problems occurred within the last month, and they tended to repeat at least monthly. One-third of all reports related to MS Outlook, and the others mentioned a variety of online interfaces. In those cases, individuals were not able to attach a file (5%), failed to open an attachment (4%), or experienced other problems (10%), such as losing messages stored on the system, receiving an unreadable email, and failing to forward a message because of a system error.

Several patterns of user actions and behavioral changes emerged. Some respondents immediately abandoned the system. Those who successfully fixed the problem did not report subsequent behavioral changes. Those who tried, but failed to find a solution, completed the task by using another system and continued using it for that specific activity in the future. Some did not even try to fix the problem; they instantly switched to another system to complete the task and continued using that system in the future. A few employed an alternative communications channel. Overall, those who failed to complete the task either minimized system usage or abandoned it.

"[The] attachment did not work . . . when I tried to send pictures . . . [I] tried to resend. . . ."

"I sent an attachment [to myself] that was 'too dangerous' for me to open later. It was a database file for my MIS project. I wanted to be able to change my settings to allow me to open attachments at my own risk but what Hotmail says goes. . . .[Now,] I use my university account to send myself attachments."

"[I was] unable to forward an email from a friend—it [MS Outlook] kept telling me that it couldn't find the file. Irritated that I was unable to forward I had to cut and paste. Resigned that it was just another hiccup I had to put up with . . . [After that,] I stopped forwarding emails in Outlook."

3.3.5 Usability issue. Negative incidents relating to usability issues constituted 12% of all reports. They mostly occurred only once a long time ago with online interfaces of Yahoo! followed by Hotmail. One-half of the incidents happened when users came across counterintuitive, unexpected functionality of the system. For example, they accidentally pressed the wrong key when typing a message online and lost the

message, realized that the "back" button worked differently than they expected, or made a change to the interface and did not know how to undo it.

> *"While writing a message [in Yahoo!] I pushed by accident a wrong key and the message was lost. Disappointed by the waste . . . I left the program. [Now,] I type it more carefully."*
>
> *"[University email] setup is annoying. I could not click 'back' button to get back to the inbox from an open message. Clicking 'back' brings you to the login page. You have to click 'Inbox' instead. I am used to clicking back in all my other email and message clients."*

Other usability responses were mentioned by single users: (1) inability to select multiple emails at once by holding the SHIFT or CTRL key; (2) clicking the "attach" button twice to attach a single file; (3) incompatibility with another email application that made it impossible to export or import email; (4) annoying popup windows with commercials; and (5) discontinued interface functions. When coming across the problem, individuals tried to fix it, repeated the task, or employed another system. A few people took no action. Those who succeeded fixing the problem reported no future behavioral changes; others became more careful when working with this system, started employing other email applications for similar tasks, or even completely abandoned the application.

3.3.6 Security breach or virus attack. Security breaches or virus attacks were mentioned in 10% of the negative incidents. Most occurred with MS Outlook and took place only once within the last year. Some users immediately abandoned the system without even trying to correct the problem, some managed to fix it (e.g., remove the virus), and several officially complained. Those who continued usage became more careful. All users were not simply disappointed; they were extremely angry about the situation.

> *"[MS Outlook] was vulnerable to a virus. [I was] angry that Microsoft cannot update their software. [I] uninstalled Outlook . . . no longer use the program."*

3.3.7 Space limit. Space limitation of an email system was presented in 7% of the negative cases when users reached their individual space limit and were not able to send and/or receive any messages. Various systems were mentioned; the incidents took place recently and repeated relatively frequently. Users had to fix the problem by cleaning their inboxes; in future, some reported no changes, whereas some switched to another system that had more space for most email activities.

> *"University email's limit set to small amount. With teachers sending out slides and things, my account fills up almost overnight and I am forced to continuously delete files permanently. Wish the administrators could free up more space. The university gives 60—Hotmail gives 250MB. [Now] all large files I have are sent to Hotmail."*

3.3.8 Other category. Several incidents were reported by only a few users, and no significant category or other pattern emerged. For example, one person indicated that the provider suddenly discontinued the service and he/she lost the account with all email stored on it. Another user stated that he/she mistakenly assumed that the system was infected by a virus, informed all contacts about it, and felt humiliated later. Table 2 summarizes all findings relating to negative incidents.

Table 2 Summary of negative critical incidents.

Incident cause	Timeliness	Frequency	Feelings	Immediate actions	Future behavior change
Server/ network problem (24%)	Short-term	Monthly	Negative	Waited, complained, repeated or abandoned task, fixed the problem	No change, some decreased usage
Spam filter issue – false positives (5%)	Short-term	Once or yearly	Negative, terrified	Manually reviewed messages	Terminated usage, controlled performance
Spam filter issue – false negatives (18%)	Long-term	Every system usage, daily, weekly	Negative	Manually reviewed messages, blocked messages, complained, terminated usage	No change, decreased or terminated usage
Client-side problem (19%)	Short-term	Weekly or monthly	Negative	Terminated usage, fixed the problem, used another system or phone	Decreased or terminated usage
Usability issue (12%)	Once	Yearly	Negative	Repeated the task, fixed the problem, used another system	Decreased or terminated usage, became more careful
Security/virus attack (10%)	Once	Yearly	Extremely negative	Terminated usage, fixed the problem, complained	Became more careful
Space limit (7%)	Short-term	Weekly and monthly	Negative	Fixed the problem	Some decreased usage

3.4 Theoretical Saturation

Theoretical saturation is that critical point in data collection and analysis when gathering new data keeps confirming the coding rather than modifying it [53]. In terms of the CIT, theoretical saturation occurs when new cases do not offer new categories or causes of critical incidents [17]. To test for theoretical saturation in the present project, the responses were sorted in the order they arrived and combined in 10 approximately equal clusters. Positive and negative incidents were analyzed separately. In the last cluster of 10% of the incidents, no new category of incident cause appeared for both positive and negative cases. Therefore, it was concluded that an acceptable level of theoretical saturation was achieved.

4. DISCUSSION

4.1 Value of the Critical Incident Technique in MIS Research

Recall that the key objective of this project was to demonstrate the potential validity of the critical incident technique in MIS research. In this study, 220 incidents provided by 71 students from two Canadian universities were collected and analyzed. This study was done to address the issue of relevance of MIS research from the practitioner perspective. In fact, in recent years, a number of scholars and practitioners argued that MIS academics have become so preoccupied with the theoretical rigor of

their studies that they ignore the practical implications of their findings. This investigation has demonstrated the application of the CIT as a rigorous inquiry method. Given that no subjects expressed difficulty understanding the instructions or questions, the viability of self-administered data collection procedure is confirmed.

In the past, the CIT has been effectively employed in a variety of management domains, and this study has shown that it may also be successfully applied in the MIS field. In this project, the CIT is suggested as a method of inquiry by which researchers may identify and measure a number of factors pertaining to a specific IT artifact or an IT issue. Specifically, it allows documenting user experiences with information technologies and the effect of human-computer interaction processes on future user behavior. In fact, it is the goal of many MIS projects to comprehend user experience with technologies in order to explain and predict their system adoption behavior. By using the critical incident technique, typical usage scenarios may be constructed that would include the following factors: incident cause, incident time, frequency of occurrence, user feelings, immediate user actions, and future behavior changes. Based on these factors, it is possible to identify incident causes that have the most dramatic impact on future user behavior. A key advantage of this technique is that the data (i.e., incidents) are generated by the end users and, therefore, are not affected by the researcher's personal biases or the research direction. As a result, a number of user-driven recommendations may be produced that are of interest to the practitioner community. In addition, theoretical concepts may be confirmed and new phenomena may be identified. The practical and theoretical outcomes of this investigation are outlined below.

4.2 Practical Recommendations

Based on the findings, several practical recommendations are suggested. While most students have multiple email accounts, they rarely use university-based systems because only a fraction of critical incidents was related to them. Instead, students prefer online interfaces of Hotmail and Yahoo!. Most likely, many had personal accounts before joining the university, which they continued utilizing in school. This practice may potentially question a need for the implementation of university-based proprietary email applications. For example, for one of the universities included in this study, the yearly maintenance costs of one student account exceed $8 US. Therefore, some universities may review the rationale and potential benefits obtained from providing email services. In fact, a few months after the completion of this study, one of the universities included in this project completely outsourced email services to Google.

In many situations, providers can do little about some problems that cause negative incidents. For example, server/network-side problems may always occur because they are often beyond schools' control. While not all issues can be corrected, an effective short-term solution is to focus on factors under an organization's control.

First, even though users appreciated the existence of a spam filter, many were disappointed by its reliability and limited personalization. Moreover, when legitimate messages were mistakenly labeled as spam, users were terrified; they discontinued system usage or started controlling future filter performance. Therefore, spam filters should present some degree of personalization. For example, users should always be able to disable filters or select sensitivity thresholds. Email providers should remember

that false positives are more likely to make users terminate system usage than false negatives.

Second, in all cases, users should be able to open any kinds of attached files that were sent by the account owner regardless of security settings. Third, most users employed online interfaces of Hotmail, Yahoo!, and Gmail not only for communication but also for file and information storage. Currently, most providers increase their mailbox size yearly, but users run out of space weekly or monthly. Therefore, providers should more frequently enlarge mailbox size by smaller amounts. In this case, users would be able to use new space as it becomes gradually available. This practice would create positive user perceptions of a responsible email provider and increase loyalty in the long-run. If the box size is increased by a large amount but only yearly, some people may switch to another provider instead of waiting.

Fourth, many users complained about server/network problems that made email temporarily inaccessible. Users could do little about server/network problems; they waited or unsuccessfully tried to fix them. Therefore, it may be a good idea to inform users when server/network problems occur. For example, if the service is unavailable, a message may be posted explaining the reason and indicating when the service will resume. In this case, people may engage in other activities instead of waiting or repeating tasks.

Fifth, various usability issues were identified when some features of a system behaved unpredictably. Indeed, users expect that all software applications, especially web-based interfaces, behave similarly. Thus, email providers should attempt to follow most common usability principles or remove unconventional features and functions from their online email interfaces. If this is impossible to accomplish (e.g., remove the "back" button that behaves unexpectedly from the browser), a warning may be displayed when a user clicks it.

Sixth, drafts of the messages that users type online may be automatically saved and removed after a message is sent. In this case, those who accidentally pressed the wrong key will not lose their work. Seventh, "undo" buttons or menu options may also be presented that allow people to cancel a recent change in the settings of an email interface. Eighth, even though most current email providers employ various server-level security features, such as anti-virus software, this is insufficient for desktop-based email clients such as MS Outlook. It is not surprising that most virus attacks happened with Outlook because Microsoft is a favorite target of hackers. Some contemporary anti-virus packages allow real-time scanning of incoming messages and attachments. It is possible that some users did not use this technology or employed outdated versions of anti-virus applications. It is suggested that providers clearly communicate the necessity for personal email protection to those who use desktop email clients.

Ninth, message search facilities, such as "find" or "sort" features in Outlook, are very important for email users. Currently, many online interfaces do not offer such features; this makes it difficult for individuals to locate old messages. It is recommended that email providers consider adding such features to their online interfaces. Tenth, a built-in capability to ensure that users do not accidentally forget to attach files is beneficial. If the word "attached" is included in the text, the system could track whether the user attached a file and prompt him/her if the attachment is missing.

In order to demonstrate the relevance of this project's practical recommendations, a number of individuals responsible for developing, administering, or supervising email activities in each institution were presented with the findings and asked for

comments. This approach is often referred to as member checking [54]. All practitioners indicated that the conclusions are innovative, novel, and interesting, and further stated that they will utilize the suggestions in future work relating to the design, implementation, and improvement of local email systems:

> *"The vast majority of these recommendations are unexpected and novel. The suggested 'attach' tracking feature has much practical merit and usefulness, but it has not been implemented at our University. The undo feature will be a very useful suggestion, to help avoid any lost work/time. The idea to post an explanation on the website when there is an issue with the server is very intuitive, yet it was not thought about before. This is a very simple and cost effective recommendation, and it will decrease user dissatisfaction during a period of frustration. All of these features would most certainly increase the usability of our email system and improve the student's experience. Unfortunately, only two of these recommendations have already being implemented (i.e., the search and the draft auto-save feature).*
>
> *Overall, most of the recommendations are practical, useful and inexpensive to implement. If the authors permit, this report will be presented to the Information Systems Senate Committee in a formal setting."*
>
> *"Our university is currently in the process of collecting input relating to email. I suspect that many of these recommendations have not yet been discussed. There is a current university project that will research the requirements of a new email system. I believe that as long as this project's recommendations are possible with the chosen solution, a good number would be implemented. It would require that the current email system be replaced with one that incorporates as many of the recommendations as possible.*
>
> *With regards to increasing email storage, the budget environment and conventional management would typically only increase the storage limits once a year. Releasing smaller amounts at a time may benefit the students, but it would require continually monitoring the environment. This could be a little problematic in the event that there are staffing issues, but this issue is worthwhile exploring further."*

4.3 Theoretical Contributions

This study's findings confirm previously known phenomena, inform about potential theoretical advancements, and help propose new questions. To further demonstrate that the application of the CIT in the MIS setting generates findings, which contribute to the existing body of knowledge, the key issues obtained in the present study were compared with those of previous projects that utilized TAM or its constructs. For this, 2,047 papers citing one of three key TAM works [55–57] were identified using Thomson Web of Science citation search. Of them, 21 actually applied TAM or its parts to email (see Table 3). Several observations are discussed below.

In the present investigation, it was found that in cases of positive critical incidents, users express positive feelings and immediately employ new information, utilize the system's functions, and follow recommendations. This relationship was reversed in cases of negative events. Regarding TAM, it echoes the link between perceived usefulness (PU) and behavioral intentions (BI); positive feelings resulting from positive system experience lead to perceptions of its usefulness and encourage usage. The present investigation also identified several factors causing positive perceptions, for example, space limit increase. However, very few such factors appeared in

Table 3 TAM-based email projects.

Study	Key findings
Adams, Nelson, & Todd [74]	Support TAM with respect to email.
Adams, Todd, & Nelson [75]	Compared to voice mail, email is more useful with respect to improving co-ordination and control within organizations.
Chin [76]	PU has a positive effect on usage. Perceived enjoyment negatively moderates this relationship.
Debrand & Johnson [77]	User gender plays an important role with respect to the usage and PU of email.
Froehle & Roth [78]	PU is an important antecedent of attitude towards usage.
Gefen & Straub [79]	Support TAM with respect to email. Male and female users differ in their perceptions but not in the use of email.
Higa, Sheng, Shin, & Figueredo [80]	For teleworkers, PEOU of email has a marginal effect on email richness and no effect on its use. A technical characteristic of PEOU is less important than social and attitudinal factors with respect to email productivity.
Huang, Hung, & Yen [81]	IM and email are similar in terms of PEOU mean scores.
Huang, Lu, & Wong [82]	Support TAM with respect to email. Subjective norm has a positive effect on PU.
Hung, Huang, Yen, & Chang [83]	PEOU has no moderating effect on the relationship between email use and task performance.
Karahanna & Limayem [84]	PEOU impacts PU and use of email. PU is influenced by accessibility, reliability, media style and social presence. PEOU is affected by media style, social presence and social influence. A TAM-based model behaves differently with respect to email and voice-mail.
Kettinger & Grover [85]	PEOU has no effect on email usage decisions.
Olaniran [86]	PEOU of email impacts user satisfaction.
Shih [87]	PU and PEOU are positively associated with perceived coordination performance in cooperative work.
Strader, Ramaswami, & Houle [58]	There is a link between PU, PEOU and BI. There is an impact of BI on usage. There is no effect of perceived network externality and spam on PU.
Straub [88]	Compared to US knowledge workers, Japanese workers perceive email to be lower in social presence and information richness, less useful, utilize it less frequently, and report lower productivity benefits.
Sussman & Siegal [89]	The quality of a message argument delivered by email and the source credibility are positively associated with message usefulness; this link is moderated by a recipient's level of expertise and involvement. Perceived message usefulness is positively associated with information adoption. Perceived message usefulness also mediates the link between the quality of message argument and the source credibility, and information adoption.
Szajna [90]	Supports TAM with respect to email. There are differences in TAM during pre-implementation and post-implementation stages.
Trevino & Webster [91]	PEOU is positively associated with (1) perceptions of flow in interactions with computer-mediated communications technologies, including email and (2) attitudes towards media usage, communications effectiveness and quantity. PEOU is influenced by a media type and the level of user computer skills. Management support is also related to PEOU.
van den Hooff [92]	PEOU of an electronic calendar system (note: it is assumed that a calendar is part of an email application) is positively related to individual and collective use of this system.
Webster & Trevino [93]	PU is an important factor influencing the selection of communications media, including email.

the TAM projects. TAM studies documented user perceptions and behaviors, but they often failed to explain the actual motives for these perceptions and behaviors.

Technology acceptance projects tend to present only a general description of the issue, such as whether cause and effect exists between two factors. In contrast, the CIT not only identifies a relationship, but also suggests whether researchers should look beyond the constructs they measure. Recently, it was demonstrated that spam has no effect on PU and usage of email [21, 58]. The present project highlighted that not only the number of unsolicited emails but also the workings of the spam filter play a key role. In addition, two different performance measures of a spam filter were identified: false positives and false negatives, which have a different impact on the usage of a particular email system. Thus, a potential moderating factor can be added to existing TAM models to explain non-significant results, which provides a plausible explanation of the previously observed non-significant effect of spam on email systems usefulness and use.

Our findings suggest that spam is a negative phenomenon that may be attributed to the system vis-à-vis its spam filters. Thus, future research may decompose email systems to two IT artifacts: the system itself (interface, storage, etc.) and the spam filter. This allows researchers to develop a more nuanced understanding of the considerations users develop when assessing email systems and, ultimately, how users form usage, switching, and referral intentions.

This study indicates that while the generic TAM framework is valuable, in the case of email, it should be expanded to include new features such as storage capacity, percent, or frequency of false-negative spam filtering incidents, etc. In line with prior research [5, 59], the integration of a theoretical framework with system features can advance the field.

It was observed that some users consider general email reliability a critical factor given that they mostly perceive all computer systems to be unreliable. On the one hand, statements regarding general reliability of email may not be considered critical incidents from the original CIT viewpoint because they do not necessarily represent a discrete episode that may be visualized [40]. On the other hand, respondents clearly emphasized the significance of the fact that their email operated reliably over a certain period of time (e.g., yesterday, during the process of message delivery). This phenomenon may be explained in light of user perceptions of computer technologies as relatively unreliable in general. Many contemporary computer users have become so accustomed to poor design, unexpected functionality, unnecessary complexity, lack of important features, and errors or bugs in many software applications that they tend not to complain about their problems [60, 61]. For example, it has been demonstrated that people are ready to accept a certain degree of poor performance of information systems without complaining [62]. At the same time, some individuals are ready to consider regular performance of a system as a critical event on its own. In the present study, when their email system reliably and effectively performed a specific task, they referred to it as a critical incident of reliable performance. Technology users from other studies also identified the reliability of systems as a positive critical event [17]. Therefore, all responses that related to email reliability were retained for analysis in this investigation. Given the responses from users, it is concluded that system reliability is an important service attribute that can be used as a foundation upon which users form perceptions and behaviors. This confirms prior MIS theories that

emphasize the importance of system reliability. For example, a Task-Technology Fit Instrument [63] also includes a reliability dimension.

In the present project, it was also found that users expect that all systems, especially online interfaces, behave similarly; this may inform MIS theories. This is a usability issue that is somewhat related to the PEOU-BI link in TAM; however, the application of the CIT particularly emphasizes the importance of user expectations of interface design. An Expectation-Confirmation Model [64] suggests that the degree of user confirmation of expectations of the system's functionality and performance affects user satisfaction with that system. The present project contributes to our understanding of the Expectation-Confirmation Model by demonstrating that interface design plays a key role in forming initial user expectations of a system. By using previous experience as a reference point, individuals expect that all online interfaces look and perform similarly; the extent to which this expectation is confirmed affects outcome variables, such as satisfaction. While similarity to an expected or known system has been mentioned in previous studies, for example, as a means for developing trust [65], there is merit in further delving into the roots of this concept. Several questions may be asked. For example, what affects the assessment of similarity? What is the magnitude of the effect of similarity on system perceptions? How does the expectation of similarity affect perceptions?

It was observed that when some users received a pleasant message, they associated positive attitudes with the system that delivered it. Based on attitude formation theory in social psychology, conditioned attitudes toward other people, events, or things may be formed through association chains [66]. The evaluative conditioning (EC) paradigm may be employed to explain why people associate the delivery of a positive message with an email application. The EC paradigm addresses the formation of attitude processes and suggests that changes in the liking or disliking of a particular object may be influenced by pairing it with other positive or negative stimuli [67–70]. In this case, a positive message was paired with the system; this event formed a user's positive attitude toward the system. Similar lines of reasoning have been followed by other management researchers [71]. It is concluded that the content of messages can predict user perceptions of email systems and the way people interact with these systems. The application of the evaluative conditioning paradigm was not previously suggested for email studies.

The demonstrated associations users make between systems and messages (and their senders) suggest that a broader view of systems, including not only the IT artifact, but the people and content associated with them, is needed for better understanding how users evaluate systems. While there is evidence of perception and cognition transference from systems to users who are associated with the systems [72, 73], little is known about the relationship among content, systems, and users (i.e., both senders and receivers). The following research questions may be explored in the future: How does the content of messages affect overall user perceptions of email systems? What is the interplay among message content, systems, senders and receivers?

Table 4 summarizes the major theoretical contributions of this project. At the same time, it is acknowledged that previous TAM-based studies dramatically contributed to the body of knowledge and should not be underestimated. There are many findings offered in Table 3 that this project did not identify. It is recommended that the CIT be used to complement other inquiry methods, to better understand current issues, and to suggest avenues for future research.

Table 4 Major theoretical contributions.

Known phenomena	Observed phenomena	Key theoretical insights
In TAM, there is a positive relationship between perceived usefulness (PU) and behavioural intentions (BI).	Positive critical incidents increased usage, and negative decreased.	The nomological validity of TAM's PU-BI link was confirmed.
TAM suggests that external variables should be included as antecedents of PU.	Storage capacity is an external variable that affects usefulness perceptions and impacts usage.	TAM may be extended by including storage capacity as a motive for user perceptions and behaviors.
The amount of spam has no effect on PU. The nature of problem (false positives and false negatives) was never considered.	The nature of problem with a spam filter (false positives and false negatives) has a different impact on the usage of a particular email system.	The nature of problem with a spam filter (false positives and false negatives) is a potential moderating factor that can be added to existing models to explain a missing link between the amount of spam and PU of email systems.
Email systems are usually viewed as a uniform IT artifact.	Spam is still a major source of negative incidents and dissatisfaction with email.	Email systems may be decomposed to at least two IT artifacts: the system itself (interface, storage, etc.), and the spam filter.
System reliability is a critical attribute, and it is part of a Task-Technology Fit Instrument.	General email reliability is a critical factor.	Consistent with prior research, the importance of general email reliability was confirmed.
An Expectation-Confirmation Model suggests that the degree of user confirmation of expectations of the system's functionality and performance affects user satisfaction with this system.	Users expect that the online interfaces of all email systems behave similarly.	The perception of system similarity is a new concept that needs to be explored further. Its causes and consequences need to be identified, for example: What affects the assessment of similarity? What is the magnitude of the effect of similarity on system perceptions? How does the expectation of similarity affect perceptions?
The evaluative conditioning paradigm from the attitude formation theory in social psychology suggests that changes in liking or disliking a particular object may be influenced by pairing it with other positive or negative stimuli.	Users associated positive attitudes resulting from receiving a pleasant message with a system delivering it. The application of the evaluative conditioning paradigm was not previously suggested in email studies.	The content of messages can predict user perceptions of email systems, and the way people interact with these systems. The following research questions may be explored in future research: How does the content of messages affect overall user perceptions of email systems? What is the interplay among message content, systems, senders, and receivers?

5. CONCLUSION

This study demonstrates that the application of the CIT in IS research yields practical and theoretical insights in the context of electronic mail usage. That is, a sufficiently large set of self-reported critical incidents was used for developing practical recommendations for email service providers and advancing research in the field. This investigation reveals that email users see mailbox size and spam filter issues as critical. Interestingly, users perceive the content of some messages to be critical as well. In other words, users associate their email account with the messages it contains and conveys. Altogether, user interactions with these service attributes form the foundation upon which perceptions, attitudes, and, ultimately, behaviors are based. It has been shown that positive incidents may lead to positive behaviors, such as usage and loyalty, whereas negative incidents may facilitate negative behaviors, such as switching.

It is acknowledged that the findings of this study are only generalizable to the relatively young population of university email users. Other user groups are likely to report incidents that were not mentioned in this paper. For example, no incidents pertaining to extreme information overload, email addiction, or email abuses were reported. However, if a different population was surveyed, for instance, business professionals, these categories would probably appear.

To the best knowledge of the authors, this project is the first documented attempt to apply the critical incident technique to study user interaction with email. It highlights the fruitfulness of using the CIT as a qualitative research approach in order to advance practice and contribute to theory at the same time. We hope that future researchers will consider the employment of this technique to bridge the gap between practical and academic research.

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