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An Empirical Study of Behavioral Factors Influencing Text Messaging Intention

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AN EMPIRICAL STUDY OF BEHAVIORAL FACTORS INFLUENCING TEXT MESSAGING INTENTION

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ABSTRACT

This manuscript provides a comprehensive review of many of the behavioral factors associated with the use of technology and tests their applicability to text messaging. The theories explored included End User Computer Satisfaction, Theory of Reasoned Action, Diffusion of Innovation, Theory of Planned Behavior, and Technology Acceptance Model. In addition, Positive and Negative Emotion factors were developed and tested to examine their influence on text messaging behavioral intention. Several statistical processes were utilized to develop and confirm the factors. The results of the study suggest that no one model can fully explain texting behavior but several factors did have a significant influence on intention at $p < .05$. These factors were Attitude, Compatibility, Ease of Use, Satisfaction, and Visibility. These factors can serve as areas that practitioners and researchers can focus on to improve text messaging intention and obtain the significant benefits of this technology.

Keywords: text messaging, SMS, Theory of Reasoned Action, Diffusion of Innovation, Technology Acceptance Model

INTRODUCTION

Text messaging, also known as "texting", refers to the exchange of brief messages, typically between 140-160 characters, sent between mobile phones over cellular networks. The term also refers to messages sent using Short Message Service (SMS). Text messaging "allows the user to send short messages quickly and privately to a specific individual." Its similarities to instant messaging and its mobile features make SMS appealing to users [40]. Text messaging is primarily person-to-person messaging, but text messages are also used to interact with automated systems. Texts may be sent via personal computers as well, generally through email clients [39].

An extension of SMS, Multimedia Messaging Service (MMS) allows users to exchange multimedia communications between technology-enabled mobile phones and other devices. MMS protocol defines a way to send and receive wireless messages that include images, audio, and video clips in addition to text [46].

In an attempt to understand text messaging behavioral factors associated with the use of technology, this manuscript explores text messaging behavior using variables from five models on human behavior: End User Computer Satisfaction (EUCS); Theory of Reasoned Action (TRA); Theory of Planned Behavior (TPB); Technology Acceptance Model (TAM); and Diffusion of Innovation (DI). The authors explored variables from each of these models for their effect on text messaging usage.

This study explored text messaging behavior using variables from the Rogers [60] model of human behavior known as Diffusion of Innovation (DI). According to Rogers, important characteristics of an innovation include:

- Relative Advantage (RA)--the degree to which it is perceived to be better than what it supersedes
- Compatibility (COMP)--consistency with existing values, past experiences and needs
- Complexity (CMPX)--difficulty of understanding and use
- Trialability (TRY)--the degree to which it can be experimented with on a limited basis
- Observability (VI)--the visibility of its results

These factors influence intention to use a new technology and its diffusion into societal behavior. Rogers' diffusion of innovation theory uses these factors as a basis for modeling intention and subsequent behavior [60]. Our study first reviews existing literature on both text messaging and Diffusion of Innovation and then applies Rogers' variables to understand and predict text messaging intention and behavior.

The Theory of Reasoned Action (TRA) model was developed by Ajzen and Fishbein [3]. The model uses three behavioral factors: attitude, subjective norm, and intention. TRA remains an important model for measuring user behavior [10, 38, 49, 68, 79, 81]. Theory of Planned Behavior (TPB) is an extension of the TRA model and was developed by Ajzen [2]. Ajzen added a new factor, perceived behavioral control to the original TRA Model.

The Technology Acceptance Model (TAM) includes two key factors, perceived usefulness and perceived ease of use that are proposed to influence acceptance of a technology. According to Davis [11] perceived usefulness is defined as "the degree to which a person believes that using a particular system would enhance his or her job performance". Perceived ease of use is "the degree to which a person believes that using a particular system would be free of effort" [11].

The End User Computing Satisfaction Instrument (EUCS) developed by Doll and Torkzadeh [14], defined five factors that influence user satisfaction: content, accuracy, format, ease of use, and timeliness. User satisfaction is defined as the "extent to which users perceive that the information system available to them meets their information requirements" [67]. User information satisfaction is often used as a measure of user perception of the effectiveness of an MIS [5, 16].

The effect of emotions on performance has been noted by many researchers [52, 62, 71]. The impact of these emotions has been included in our study.

LITERATURE REVIEW

Text messaging

Text messaging is one of the fastest growing communications mediums in the United States. In June of 2008, 75 billion text messages were sent in the U.S. alone [69]. In late 2007, the number of text messages had surpassed the number of phone calls and this differential has continued to increase. During the second quarter of 2008, the average U.S. mobile user placed or received 204 phone calls each month. In comparison, the average mobile user sent or received 357 text messages per month (In U.S., SMS Text Messaging, 2008). It is being used by business and in the political arena. One of the most notable text messages was used by President-Elect Barack Obama to announce his Vice President selection to 2.9 million mobile users. Text messaging services, such as *kgb,* were flooded with inquiries upon the news of the Michael Jackson's death [80].

Some of the advantages of text messaging are:

- Text Messaging is silent communication, so it is more discreet than a phone conversation;
- It is often less time-consuming to send a text message than to make a phone call or send an e-mail;
- Text messages can be used to send a message to a large number of people at a time;
- Text messaging subscription services can be used to get medication reminders sent to your phone, along with weather alerts and news headlines [26].

There were over one trillion text messages sent and received in the U.S. in 2008 [57]. Text messaging usage "exceeds 5 billion text messages per month in the United States and will account for 68 percent of data revenues by 2010" [43]. The use of text messaging by teens has increased since 2006, both in overall likelihood

of use and in frequency of use. Text messaging usage increased from 51% in 2006 to 58% in 2008, regardless of cell phone ownership. Table 1 shows teen daily communication methods and usage. For daily activities, cell phone-based communication is dominant, with nearly 2 in 5 teens sending text messages every day. The daily use of teen text messaging was up from 27% in 2006 to 38% in 2008 [39].

Table 1: Teen's daily activities*

Activity	All teens
Send text daily	38%
Call on phone daily	36%
Talk on landline daily	32%
Spend time with friends in person daily outside of school	29%
Send messages via social networks daily	26%
IM daily	24%
Send email daily	16%

*Source: (Lenhart, 2009)

A study done by Nielson [49] found that the average number of monthly texts sent by teens from the age of 13 to 17 was 1742. Whereas, the average number of texts for adults between the ages of 18 and 24 was only 790; the usage was even less for older adults (In U.S., SMS Text Messaging, 2008). According to Knutson [35], 82% of adults 18-24 are avid text message users. Of the 25-49 age group, 72% use text messages. However, 53% of those who send and receive text messages are 35-years-old and up. Among social network users, 54% of teens on those sites send IMs or text messages to friends through the social networking system [39].

"Cell phones and computers have become essential to the average American teenager's social life" and the average American teen spends four hours per day interfacing with some sort of device [75]. According to German technology advocate Bitkom, "people age 14 to 29 would rather give up their relationship partner than their cell phone—by a 2-to-1 margin." [50].

According to the Pew Internet & American Life Project [39], "girls are more likely than boys to send and receive text messages frequently, as are older teens ages 15-17." Forty-two percent of the girls send text messages to friends daily, while about a third (34%) of boys do the same. Frequency of use between younger and older teens is significant; fifty-one percent of teens aged 15-17 sent daily text messages compared to 25% of teens ages 12-14. The study found no racial or ethnic differences in text messaging usage. Forty-two percent of teens from households that earned greater than $50,000 send text messages daily, compared to 33% of teens whose family incomes were less than $50,000 per year [39]. According to Mahatanankoon [43], "text message users are younger and better educated." The author also observed that gender has no significant effect on text-messaging activities.

Igarashi, Jiro, & Toshikazu [28] studied Japanese university freshman and looked at the gender differences in communication via text messaging. They determined that the volume of text messaging did not vary by gender. However the social relationship network maintained by text messaging was different. At later stages of text messaging females tended to form a large group comparable to face to face communication. Pruthikrai [56] found that gender had no significant effect on text-messaging activity.

Thirty-eight percent of U.S. mobile phone users, or 72 million subscribers, engage in text messaging. In June 2006, the number of wireless subscribers in the United States is 219 million, with wireless use exceeding 850 billion minutes [43]. A 2009 UN report that showed more than half the global population has a mobile phone subscription. By the end of 2008, there were an estimated 4.1 billion mobile phone subscriptions, up from 1 billion in 2002; that represents 60% of the world's population [74]. According to Pew Internet, cell phone ownership among adults in the U.S. has risen to 85%. Eighty-four percent of all teens had their own cell phone by the time they reached age 17. Mobile phone usage among teens has climbed steadily from 63% in 2006 to 71% in 2008. Ninety-four percent of them have used their mobile phones to call friends and 76% have sent text messages [39]. Smartphone users are in general more active in using text messaging services than users equipped with basic mobile phones [66].

Teens aren't the only ones who are currently texting or who are interested in texting. "Text messaging and the Internet are facing increased demand among 18 to 34 year olds." [54]. Research shows that 40% of the baby boomers, those born between 1946 and 1964, seek help in social networking, iTunes, and text messaging from Generation Y people, or those born between 1979 and 1994. For example, "Time Warner has launched a Digital Reverse Mentoring Program between their executives and technology savvy college students." [21] According to Zaslow [83], this generation has a gift for multi-tasking. "While older colleagues waste time holding meetings or engaging in long phone conversations, young people have an ability to sum things up in one-sentence text messages…they know how to optimize and prioritize."

Text messaging isn't just for personal use. A survey done by Harris Interactive found that 42% of 18-to-24 year olds and 33% of 35-to-44 year olds are "at least somewhat interested in receiving opt-in mobile alerts from their favorite businesses" [61]. SMS is ideal for "small, 'bursty' amounts of traffic", which means there are opportunities for countless business uses. SMS provides an additional reliability advantage, "as it's more widely available than the 3G network required for an IP connection" [41]. "At the moment the majority of text messages `are sent by individuals to individuals and are of a personal nature. It is mostly being used as an effective one-to-one method of communication between friends [64] but business has started to realize that text messaging is a good way to stay in touch with distant employees and to carry out business activities" [17].

Perkins [50] asserts that 95% of all text messages are opened and read, but few companies take advantage of SMS technologies. For example, at a recent conference for IT managers, "half of the 500 attendees admitted that they were unable to send a text message." [50]. Compared with a paper communication or voice call SMS messaging is a very low-cost channel, "requiring no printing, postage or human intervention." SMS messaging provides a "huge speed and efficiency gain over other forms of notification" and is "significantly less expensive than reaching customers through newspapers, radio, TV, e-mail or direct mail." [50].

According to Venezia [76], "When banks ask their customers if they are interested in receiving bank communications by short messaging service" the results were a resounding "yes" from teenagers, other young people, working adults, stay-at-home moms and retirees. Currently, 15 million customers opt in to receive bank communication by SMS. "SMS messages are more discreet than phone calls, so a customer who would not appreciate her banking calling her at work to advise that her account is in danger of being overdrawn might welcome the arrival of an SMS with the same warning."[76]. Banks use text messaging to send daily messages to customers detailing their current balance or recent transactions. It is a way of keeping in touch with their banking customers "without being excessively intrusive."

Short message service texts are being used as a direct marketing strategy for the restaurant industry. According to Bryce Marshall, director of strategic services at a digital direct marketing firm, "There needs to be an understanding of how quickly habits, perceptions, and the role of mobile devices in our lives are changing" [61].

According to Perkins [50], "Pioneering efforts to use texting in business vary widely." Examples include Disney & ESPN, who encourage viewers to participate in programming via SMS, use text messaging to find information on concert and sporting events, and to participate in "text to win" programs.

Lesch [41] forecasts text messaging will benefit from machine-to-machine (M2M) short message service (SMS). "M2M SMS will be the major growth area of text messaging in 2010, driven by cost savings." An example of M2M SMS technology is when an off-site trash can automatically sends an SMS when it is full, "eliminating the need for staff to drive to locations unnecessarily."

Advantages of SMS technology for businesses include; less spam, rapid market penetration, trust and opt-in policies [50]. There are additional uses for text messaging including pedagogical, medical and charitable applications. A major university in Shanghai China has "developed a cutting-edge mobile learning system that can deliver live broadcasts of real-time classroom teaching to online students with mobile devices." The system supports SMS texting and instant polls [63, 78].

A program called Stop Smoking over Mobile Phone (STOMP) is a smoking cessation text messaging service of the department of public health in Mohave County AZ. Subscribers receive personalized text messages about smoking while they are trying to kick the habit over a 26-week period [7]. A study done by economists looked at the effect on people's savings balances when they received reminders that incentivized them to save their money. They observed an increase of 6% in the savings accounts of those who received the SMS reminders [53].

Who can forget the devastating January 12, 2010 earthquake in Haiti? By using cellular phones to text donations, the American Red Cross raised $22 million dollars in pledges in just six days. A Red Cross spokesman was quoted as saying, "I need a better word than unprecedented or amazing to describe what's happened with the text-message program." [70]. Other agencies have subsequently used text-messaging to encourage charitable donations.

Factors and Mathematical Models

End User Computing Satisfaction

Several of the factors that were used to evaluate the affect of text messaging behavior were taken from the dimensions used in the End User Computing Satisfaction Instrument, shown in Figure 1. The EUCS instrument was developed by Doll and Torkzadeh [14] and is an extension of the User Information Satisfaction Model (UIS), that was previously developed by Ives, Olson and Baroudi [31]. The EUCS model has been shown through

confirmatory analyses, test-retesting and validity testing to have content, construct, and external validity [15, 16, 24, 29, 34, 44].

The EUCS instrument defines five factors that influence user satisfaction: content, accuracy, format, ease of use, and timeliness. To measure end user satisfaction Doll et al.[16] developed a 12 item questionnaire shown in Table 2 [67].

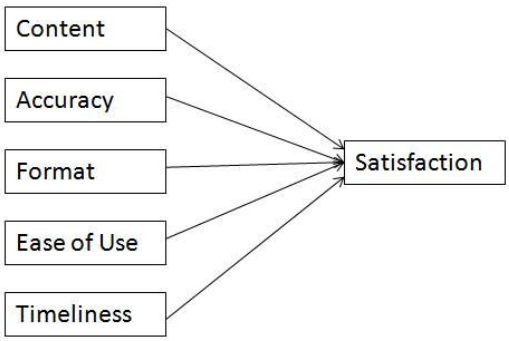

Figure 1: End User Computing Satisfaction Instrument

Table 2: End User Satisfaction Survey

Factor	Question
Content	Does the system provide the precise information that you need? Does the information content meet your needs? Does the system provide reports that seem to be just about exactly what you need? Does the system provide sufficient information?
Accuracy	Is the system accurate? Are you satisfied with the accuracy of the system?
Format	Do you think the output is presented in a useful format? Is the information clear?
Ease of Use	Is the system user friendly Is the system easy to use?
Timeliness	Do you get the information you need in time? Does the system provide up-to-date information?

The EUCS instrument has been widely used and applied to a number of different information systems. For example, Somers et al [67] confirmed previous findings that the EUCS instrument maintains "psychometric stability" when applied to users of enterprise research planning software [67]. Ilias et al. [29] further supported the EUCS instrument when it measured level of satisfaction among the end-users of computerized accounting system (CAS) in private companies (Ilias & Suki, 2008). Wang et al. [78] validated the EUCS instrument in determining group decision support systems satisfaction. Abdinnour et al. [1] found the EUCS instrument to be a valid measurement for web site satisfaction. Raunier et al used an altered version of the EUCS to determine buyer satisfaction of C2C online auction website. They determined that the C2C auction website content, user friendliness (a auction format and ease of use), timeliness, security, transactions, and product varieties are positively related to the website performance for the auction buyer [58].

Diffusion

Diffusion of Innovation theory is a theory of communication and adoption of new ideas and

technologies. There are numerous studies on IS implementation using innovation diffusion theory in the IS literature, and three are widely cited: Rogers [60]; Kwon & Zmud [36] and Tornatzky & Fleischer [73]. Rogers' model has been frequently cited and is well established in the diffusion theory literature. Rogers defines innovation as "an idea, practice, or object that is perceived as new by an individual or other unit of adoption."[60]. He defines diffusion as "the process by which an innovation is communicated through certain channels over time and among the members of a social system." In other words, the diffusion of innovation evaluates how, why, and at what rate new ideas and technology are communicated and adopted.

Rogers [60] identified five factors that strongly influence whether or not someone will adopt an innovation. These factors are: relative advantage, complexity, compatibility, trialability and observability. The relative advantage is the degree to which the adopter perceives the innovation to represent an improvement in either efficiency or effectiveness in comparison to existing methods. The majority of studies have found that the relative advantage is significant [55, 72]. Ilie, et al. [30] found that relative advantage was significant for men, but not for women.

The complexity is the degree to which the innovation is difficult to understand or apply. The compatibility refers to the degree to which an innovation is perceived as being consistent with the existing values, past experiences, and needs of potential adopters. Premkumar and Ramamurthy [55] found that the greater the complexity the slower the rate of adoption. Ilie, et al (2005) found when referring to instant messaging, for example, women placed more importance on the ease of use than did men.

Trialability refers to the capacity to experiment with the new technology before adoption. Observability or visibility refers to the ease and relative advantage with which the technology can be seen, imagined, or described to the potential adopter. Ilie, et al (2005) found another variable, critical mass, to be the most significant predictor in their study of instant messaging behavior.

According to Rogers [60], most innovations diffuse over time in the shape of a cumulative S-shaped curve. Critical mass occurs when enough individuals have adopted the innovation and its further rate of adoption becomes self-sustaining. Essentially, the diffusion process for all innovations consists of individuals talking to one another about the new idea, thus decreasing the perceived uncertainty of the innovation.

Rogers [60] identified four main elements that affected the adoption of innovation: (1) the innovation, (2) communication channels, (3) time, and (4) the social system. The innovation is the new product or service. The communication channel is the means by which messages are transmitted from one individual to another. Time refers to the amount of time it takes to adopt the new innovation. The social system is the set of interrelated units that are devoted to joint problem-solving, to accomplish a common goal [60].

Theory of Reasoned Action

In order to explore influences on text messaging behavior, factors from a common model, the Theory of Reasoned Action (TRA), developed by Ajzen and Fishbein [3], was selected. The model uses three factors: attitude, subjective norm, and intention. TRA has continued to be an important model for measuring user behavior [10, 38, 49, 68, 79, 81]. The model is shown in Figure 2.

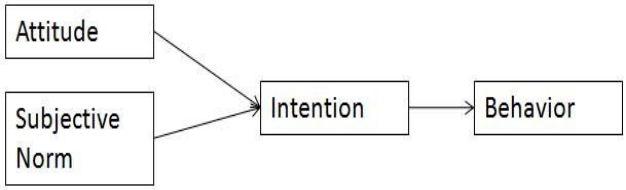

Figure 2: Theory of Reasoned Action Model

Intention to use is a common behavioral factor [4, 42 (Bahmanziari, Pearson, & Crosby, 2003; Lu, Yu, & Liu, 2005). Actual behavior generally follows intention in a variety of models [4, 59]. Definitions of the models factors are as follow:

- Attitude is how we feel about the behavior and is generally measured as a favorable or unfavorable mind-set.
- Subjective norm is defined as how the behavior is viewed by our social circle or those who influence our decisions.
- Intention is defined as the propensity or intention to engage in the behavior.
- Behavior is the actual behavior itself.

TRA was selected because it has shown successful application to general consumer information technologies [22,36] and organizational knowledge sharing [36]. In addition, "Hsu and Lin [27] found one important TAM construct, perceived usefulness, did not directly affect behavioral intention; while the two TRA constructs, attitude and subjective norms did" [81]. Hsu and Lin [27] developed a model based on TRA involving

technology acceptance, knowledge sharing and social influences. Their results found that ease of use and enjoyment, and knowledge sharing were positively related to attitude toward blogging. They also determined that, social factors and attitude toward blogging significantly influenced a blog participant's intention to continue to use blogs.

Jiang [32] did an exploratory study on consumer adoption of mobile internet servers using TRA and components of the theory of innovation adoption. He found that "beliefs and quality perceptions play a significant role in influencing intentions to adopt mobile internet." He determined that computer skills, knowledge of mobile internet and career mobility are all positively related to adoption.

Dinev et al [13] used TRA and structural equation modeling to understand on-line advertiser behavior. They found that beliefs about on-line pay-per-click advertising shape the attitudes and subjective norms that lead advertisers to advertise on-line. Their studied confirmed that attitudes and subjective norms significantly influence intention to advertise on-line using the pay-per-click model.

Theory of Planned Behavior

Ajzen's Theory of Planned Behavior (TPB) is an extension of Ajzen and Fishbein's TRA Model [2,3]. TPB includes an additional factor, perceived behavioral control which is a person's "perceptions of their ability to perform a given behavior" [2]. The factor was added to eliminate the limitations of the TRA when dealing with behavior which is not under volitional control. TPB takes into account that behaviors are located at some point along a continuum that extends from total control to a complete lack of control. The theory of planned behavior has been extensively validated and successfully applied in a variety human behavioral research.

Liao et al. (2010) developed a model integrating perceived risk and TPB for predicting the use of pirated software. They found that attitude and perceived behavior control did contribute significantly to the intended use of pirated software. However, they did not find a direct relationship between subjective norm and intention to use pirated software.

Hartshorne & Ajjan [23] used the Decomposed Theory of Planned Behavior to better understand factors that influence student decisions to adopt Web 2.0 tools. Their research found that student attitudes and their subjective norms are strong indicators of their intentions to use Web 2.0.

Lee's [38] study extended the "theory of planned behavior (TPB) with flow experience, perceived enjoyment, and interaction to propose a theoretical model to explain and predict people's behavioral intention to play online games." He found that both models explain players' intention to play online games but the extended TPB model provided a better fit. It explained a relatively high proportion of variation in the intention to play online games. He also determined that subjective norm had a significant influence on players' continued intention to play.

Technology Acceptance Model

One of the most important models for understanding adoption of information technology is the Technology Acceptance Model (TAM). The model was first proposed by Davis[11] in 1989 and includes two key factors, perceived usefulness and perceived ease of use that are proposed to influence acceptance of a technology. According to Davis[11] perceived usefulness is defined as "the degree to which a person believes that using a particular system would enhance his or her job performance". Others have extended this definition to include overall task performance [65]. Again, according to Davis [11] perceived ease of use is "the degree to which a person believes that using a particular system would be free of effort". Hong et al. [25] found that perceived ease of use was the most important driving force in forming a positive attitude toward continued usage of mobile data services.

In an earlier model, Davis, Bagozzi, and Warshaw [12] suggested external variables as a key influencing variable, but later Venkatesh and Davis [77] suggested that external variables are mediated by TAM; however this variation has not been included in our model. The original Technology Acceptance Model is illustrated in Figure 3. [77].

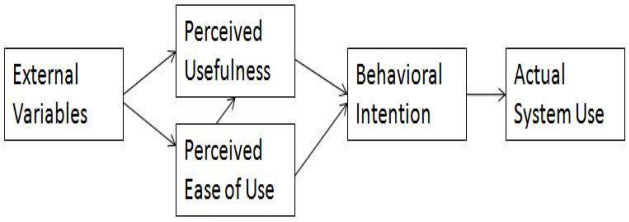

Figure 3: Technology Acceptance Model

The TAM model has been used in evaluation of the acceptance of a range of different technologies. For example, Kleignen et al. used a modified TAM to evaluate the factors contributing to the adoption of mobile services in relation to wireless finance [33]. The factors:

perceived cost, system quality and social influence were added to the original TAM model. They determined that the effect of perceived usefulness had a stronger positive effect on usage intentions for younger consumers than older consumers. Also the model indicated a significant impact of attitude and social influence on the intention to use wireless services.

Lai et al. [37] integrated the Diffusion Model with TAM to evaluate their capacity in the context of internet banking acceptance. Their findings suggest that the proposed integrated model is significantly better in explaining the variance in internet banking acceptance than either the Diffusion Model or the TAM alone [37]. Bhattacherjee and Harris [9] proposed a predictive model of individual IT adaptation by integrating factors from the technology acceptance model and adaptive structuration theory (AST). The model was validated using data collected from a study of My Yahoo web portal usage. Adaptation usefulness was the largest predictor of IT adaptation, followed by IT adaptability and ease of adaptation. The determination of adaptation was enhanced IT usage and the effect of IT adaptation on usage was moderated by users' extent of work adaptation [9].

Emotions

Many researchers have found that emotions can play a role in performance. Peslak and Stanton [51] found emotions to have an impact on team performance. Other researchers, Glinow et al.,[20] and Sy et al. [71] have shown that emotions can play a significant role in project success. To study the impact of emotions on text messaging, a group of 14 emotions was included in the survey. The list was extracted from Shaw [62] and others. Though no definitive emotions lists exist, the Shaw source [62] coupled with other relevant emotions from the literature review provided a comprehensive mix of positive and negative emotions. The emotions broadly fell into two categories of positive and negative emotions.

RESEARCH APPROACH

A survey was developed that included key questions used in the development of past studies of Theory of Reasoned Action, Technology Acceptance Model, Theory of Planned Behavior, End User Computer Satisfaction, and Diffusion of Innovation. Table 3 shows the variables, model, and source for questions that were used in this study. The study was pre-tested with a small group of students and then administered to students and faculty at two Northeastern universities and professionals in industry.

Table 3: Factor Models and References

Variable	Model	Questions adapted from
Attitude	Theory of Reasoned Action/TPB	Fitzmaurice [18]
Compatibility	Diffusion of Innovation	Ilie, Van Slyke, Green, & Lou [30]
Complexity	Diffusion of Innovation	Ilie, Van Slyke, Green, & Lou [30]
Critical Mass	Diffusion of Innovation	Ilie, Van Slyke, Green, & Lou [30]
Ease of Use	Technology Acceptance Model /EUCS	Davis [11]
Intention	Theory of Reasoned Action/TPB/DI/TAM/FLOW	Venkatesh & Morris [77]
Negative Emotions		Peslak [52]
Perceived Behavioral Control	Theory of Planned Behavior	George [19]
Positive Emotions		Peslak [52]
Relative advantage	Diffusion of Innovation	Ilie, Van Slyke, Green, & Lou [30]
Satisfaction	Expectation-Confirmation Theory	Bhattacherjee [8]
Subjective norm	Theory of Reasoned Action/TPB	Fitzmaurice [18]
Timeliness	End User Computer Satisfaction	Abdinnour-Helm, Chaparro, & Farmer [1]
Trialability	Diffusion of Innovation	Ilie, Van Slyke, Green, & Lou [30]
Usefulness	Technology Acceptance Model/ECT	Davis [11]
Visibility	Diffusion of Innovation	Ilie, Van Slyke, Green, & Lou [30]

The statistical analyses were based on a sample of 153 valid surveys. Of the surveys collected 42% were from males and 58% were from females. Overall, the average age was about 33 years of age, but the largest group was the 18-24 year old students. There was a large portion of the sample (45%) over 24. There were 89 female participants and 63 male participants. Gender mix was good with 58% female and 42% male. The graph in Figure 4 shows the age distribution. Fifty-five percent of the respondents were students and 45% were not.

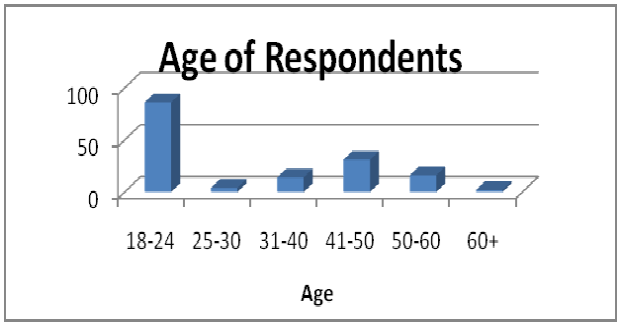

Figure 4: Age Distribution of Respondents

Another demographic question examined the current professional status of the respondent, whether they were a student, a faculty member, and IT professional or from the private sector. 86(57%) of the respondents were students, 11(7%) faculty, 11(7%) IT professionals, and 43(29%) were from others. In general, it is suggested that the sample has a reasonable mix of gender, age, and professional status.

Factor Development

From the survey responses, confirmatory factor analysis was performed and all factors were confirmed. The questions measured a five point Likert scale with level of agreement from 1 = strongly agree to 5= strongly disagree. SPSS 16 and AMOS 16 were used to analyze the data and test the proposed hypotheses. Factor analysis and scale reliability as well as structural equation modeling were conducted similar to Wooley & Eining [79], and Moore [45].

RESULTS

Confirmatory factor analysis and scale reliability testing were used to determine the factors used in the model. All the factors were confirmed with one component determined and eigenvalues over 1.0 which is generally seen as the level of acceptability [45]. The component matrix elements all were above .5 (minimum acceptable, Moore [45]) and scale reliability provided Cronbach's alphas between of .792 and .992 well above the minimum acceptable of .7 (Nunnally [48]) A summary of the factors, number of questions per factor, eigenvalues for each one factor, percent of variance explained by the factor and the alphas for each are shown in Table 4.

The questions used in the factor analyses are shown in Tables 5 and 6. As noted each of the factors extraction components were all above .5.

Table 4: Summary of Confirmatory Factor Analyses

Factor	Number of items	Eigenvalue of one factor	% of Variance	Chronbach's alpha
Attitude	5	4.668	93.365	.982
Compatibility	4	3.447	86.185	.946
Complexity	3	2.204	73.479	.819
Critical Mass	3	2.867	95.565	.977
Ease of Use	4	3.069	76.729	.897
Intention	3	2.955	98.510	.992
Negative Emotions	7	5.275	75.355	.945
Perceived Behavioral Control	3	2.130	71.000	.792
Positive Emotions	7	4.814	68.765	.923
Relative advantage	6	4.895	81.579	.954
Satisfaction	4	3.729	93.236	.975
Subjective norm	4	3.288	82.192	.927
Timeliness	2	1.910	95.494	.951
Trialability	4	2.504	62.594	.782
Usefulness	5	4.297	85.932	.956
Visibility	4	3.670	91.740	.958

Table 5: Attitude Factors and Corresponding Questions

Factor	Question	Initial	Extraction
Attitude	Text messaging is good.	1.000	.949
	Text messaging is useful.	1.000	.927
	Text messaging is worthwhile.	1.000	.926
	Text messaging is helpful.	1.000	.950
	Text messaging is valuable.	1.000	.916
Critical Mass	Many people I know use Text messaging.	1.000	.951
	Many people use Text messaging.	1.000	.934
	Many people I know will continue to use Text messaging.	1.000	.982
	Many people I know use Text messaging.	1.000	.951
	Many people use Text messaging.	1.000	.934
Complexity	Text messaging is frustrating.	1.000	.706
	Text messaging requires a lot of mental effort.	1.000	.746
	Text messaging is cumbersome.	1.000	.752

Table 5 (cont.)

Compatibility	Text messaging is compatible with how I communicate.	1.000	.884
	Text messaging fits well with how I like to communicate.	1.000	.880
	Text messaging is completely compatible with my current situation.	1.000	.831
	Text messaging fits my style.	1.000	.853
Ease of Use	It is easy to become skilled Text messaging.	1.000	.787
	Text messaging is clear and understandable.	1.000	.585
	Text messaging is flexible.	1.000	.822
	Text messaging is easy to do.	1.000	.875
Intent	I predict I will use Text messaging.	1.000	.978
	I intend to use Text messaging.	1.000	.992
	I plan to use Text messaging.	1.000	.986
Perceived Behavioral Control	Text messaging is entirely within my control.	1.000	.794
	I have all the resources, knowledge, and ability to use text messaging.	1.000	.753
	Text messaging allows me to exercise greater control over my life.	1.000	.583
Relative Advantage	Text messaging improves my performance.	1.000	.822
	Text messaging allows me to exercise greater control over my life.	1.000	.780
	Text messaging improves my effectiveness.	1.000	.880
	Text messaging allows me to accomplish my goals more quickly.	1.000	.857
	Text messaging provides an overall advantage to me.	1.000	.793
	Text messaging improves my productivity.	1.000	.763
Subj. Norm	Most people who are important to me think I should use Text messaging.	1.000	.878
	Close friends and family think it is a good idea to use Text messaging.	1.000	.777
	Important people want me to use Text messaging.	1.000	.861
	People who I listen to could influence me to use Text messaging.	1.000	.772
Useful	I find Text messaging useful.	1.000	.684
	I can improve my performance by Text messaging.	1.000	.889
	I can accomplish things more quickly by Text messaging.	1.000	.878
	I can enhance my effectiveness by Text messaging.	1.000	.937
	I can improve my productivity by Text messaging.	1.000	.908

Table 5 (cont.)

Visibility	I have seen many people Text messaging.	1.000	.938
	It is easy to observe others Text messaging.	1.000	.931
	There is plenty of opportunity to see others Text messaging.	1.000	.919
	I have seen others Text messaging.	1.000	.882
Trialability	It is easy to try Text messaging.	1.000	.875
	It is easy to start Text messaging.	1.000	.882
	I had little difficulty using Text messaging on a trial basis.	1.000	.382
	There is low financial risk in trying Text messaging.	1.000	.365

Table 6: Attitude Factors and Respective Emotions

Factor	Emotion	Initial	Extraction
Negative	Disappointed	1.000	.763
	Uninspired	1.000	.649
	Angry	1.000	.831
	Apathetic	1.000	.705
	Worried	1.000	.766
	Disgusted	1.000	.867
	Irritated	1.000	.693
Positive	Proud	1.000	.564
	Pleased	1.000	.681
	Relieved	1.000	.705
	Optimistic	1.000	.757
	Calm	1.000	.594
	Enthusiastic	1.000	.778
	Stimulated	1.000	.734
Satisfaction	Pleased	1.000	.967
	Satisfied	1.000	.947
	Contented	1.000	.949
	Delighted	1.000	.867

Regression Results

The general objective of the study was to determine what if any factors were associated with behavioral intention to text message. The factors found in the confirmatory analysis were included in a general multiple linear regression analysis, the results of which are shown in Tables 7 through 9. Overall the fifteen factors were included in the multiple regression analysis using SPSS 17.0. The resulting analysis found that of the fifteen factors, only five had a significant influence on text messaging intention at $p < .05$. Significant factors were Attitude, Compatibility, Ease of Use, Satisfaction, and Visibility.

Table 7: Text Messaging Model Summary

Model	R	R Square	Adj. R Square	Std. Error of the Estimate
1	.913[a]	.834	.799	.42414454

a. Predictors: (Constant), Try, PosEmot, Compatibility, Satisfact, SubjNorm, Complex, CrtitMass, NegEmot, RA, Time, EaseUse, Useful, Visible, Attitude, PBC

Table 8: Text Messaging Model Anova

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	64.302	15	4.287	23.829	.000[a]
	Residual	12.773	71	.180		
	Total	77.074	86			

a. Predictors: (Constant), Try, PosEmot, Compatility, Satisfact, SubjNorm, Complex, CrtitMass, NegEmot, RA, Time, EaseUse, Useful, Visible, Attitude, PBC

b. Dependent Variable: Intent

Table 9: Text Messaging Model Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.047	.047		.985	.328
	Attitude	.333	.122	.351	2.735	.008
	CrtitMass	-.182	.143	-.189	-1.275	.206
	Complex	-.042	.069	-.042	-.606	.546
	Compatility	.249	.070	.255	3.569	.001
	NegEmot	-.072	.072	-.071	-1.001	.320
	PosEmot	.091	.072	.096	1.260	.212
	EaseUse	.259	.100	.271	2.580	.012
	PBC	.035	.128	.036	.275	.784
	RA	-.177	.109	-.188	-1.628	.108
	Satisfact	-.160	.063	-.162	-2.552	.013
	SubjNorm	.082	.077	.085	1.072	.287
	Time	.034	.102	.035	.336	.738
	Useful	.031	.117	.033	.268	.789
	Visible	.361	.125	.381	2.882	.005
	Try	-.020	.093	-.021	-.213	.832

a. Dependent Variable: Intent

Surprisingly, the most important factor as measured by the correlation coefficient was visibility. The ubiquity and observability of others using the technology had the strongest influence on intention. How we feel about the technology, our attitude was the second strongest factor in the regression analysis. Not surprisingly, the ease of use of the technology played the next most important role. Texting simplicity encourages usage. The compatibility with style and communication preference was the next most significant factor positively influencing texting behavior.

Finally, level of satisfaction was slightly negatively correlated with texting satisfaction. The reason for this is uncertain but perhaps those who have all their needs met with initial texting are less likely to engage in more frequent texting. The somewhat asynchronous nature and need to exchange messages for clarification may be the cause of the lowered satisfaction levels. This study is the first to examine factors from a broad array of available influencing variables and determine those significant and relevant to the new technology text messaging. Significant further work is required to confirm these results and more thoroughly understand the reasons behind these finding. Nevertheless, this study provides a valuable starting point to fully understand text messaging.

LIMITATIONS AND IMPLICATIONS

As with any study there are limitations to this study. First, the study examines primarily traditional students and administrators at two undergraduate university locations. Results ought to be replicated across other locations. Though this group does represent a population of significant users, results may be different with non-students or with other age groups. Another limitation is the sample size. Though sizable, the number of participants can be increased to improve reliability.

Overall it has been demonstrated that a series of five factors can serve as a proposed model for text messaging behavior. Research has shown that text messaging provides exclusive advantages over other electronic communications methods including email. But, text messaging is used much less frequently in both older individual and business usage. Understanding the factors associated with intention and behavior associated with text messaging can focus efforts to increase text messaging usage.

First, it was shown that intention to use text messaging is positively and significantly affected by visibility of text messaging and attitude toward it. It has been suggested that use of a technology can be improved if users are educated about the benefits of the technology. [6, 82]. Training in the workplace or in colleges or high schools on the benefits and advantages of text messaging can allow greater use of this technology and improve overall communications. As a result, significant positive cost and productivity improvements for businesses and organizations are possible.

Another finding is that ease of use is significantly and positively associated with intention to use TM. New releases of text messaging hardware and software have made the technology extremely easy to use and this feature needs to be demonstrated to organizations and individuals. This can spur growth and use of the technology. In addition, ease of use was found to affect usefulness, again an area that can easily be demonstrated to potential users to spur usage.

The study clearly demonstrated as well that compatibility with TM correlates with intention to use TM. We need to educate on how text messaging is compatible with other forms of communication such as email. Finally, all these factors seem to fit together in a workable, usable model which can be the basis for further research in technology acceptance. The model can be tested for other user interface and consumer device acceptance and usage.

CONCLUSION

Overall this study has provided significant factors that influence and model text messaging intention and behavior. We see this as the start of an exploration of ways to increase and improve penetration of this valuable communications technology. Studies can be developed to confirm these findings with larger and more diverse sample groups, but preliminary findings suggest that text messaging does adhere to the preliminary model and is thus subject to efforts to improve behavior through attention to the significant influencing factors of Attitude, Compatibility, Ease of Use, and Visibility. Overall, this is a fertile research area that deserves further attention.

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