# Main Factors Influencing Mobile Commerce Adoption

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**Abstract**

Mobile commerce provides organizations with the means to sell products and services to customers and to deliver vital information to employees at any time and any locations. This allows customers and employees to be anywhere and not to be physically connected by a wire to the Internet.

This study utilizes the social cognitive and other factors unique to the M-commerce environment to investigate how different factors influence the adoption and usage of mobile commerce.

A survey with both an online and a paper versions was completed by 99 participants, out of which 95 were useful responses. The respondents were mostly students at a public university located in a southeastern part of Michigan with median income of $9600 and median age of 20. In the responses, an age range of 60 and an income range of $250,000 were also presented indicating that not every respondent was a typical college student. There were 45 female respondents and 49 male respondents. Most respondents stated that they had between 1 and 3 years of education after high school, but the responses had a range of 15.

The survey consisted of some demographic questions followed by scales to measure computer anxiety, perception of mobile risk, mobile anxiety, mobile self-efficacy, and mobile commerce usage. Out of these scales, the one for computer anxiety was not very reliable as it had a Cronbach's alpha of 0.603. This might have been due to the scale that the questions were derived from being too old to provide reliable measurement. This appeared to be surprising as the scale was fundamentally similar to the mobile anxiety scale, which met the standard for validity.

The outcomes of this study indicate that relationships exist between computer anxiety and mobile commerce adoption, between mobile risk and mobile commerce adoption, between mobile self-efficacy and mobile commerce, between computer anxiety and mobile anxiety, and between income and mobile commerce adoption.

## Introduction

Mobile commerce commonly known as M-commerce is rapidly expanding as mobile technology evolves. M-commerce is defined by Clarke (2008) as "the ability to purchase goods anywhere through a wireless Internet-enabled device" [1]. M-commerce creates opportunities for

reaching customers at numerous locations for configuring and offerings services in new ways and enabling new types of shopping and service consumption experiences [2]. The increase use of smart phones has given consumers greater capabilities than before. The Apple, Amazon, Google and other companies have capitalized on the M-commerce market by developing app stores.

Most of the literature on M-commerce appeared during 2001 to 2008. The publications in recent years have focused less on defining M-commerce. Mobile phone companies adding 4G to their networks and the portable tablet computer are not included in earlier publications on M-commerce. The majority of the literature written on M-commerce predates 4G networks and tablet computers similar to the iPad are newer mobile technologies.

Mobile technology has expanded since 2008 and so has M-commerce. M-commerce is not e-commerce but has its own separate market [3]. Not everyone views M-commerce as its own market but as a subset of E-commerce [4]. It is stated by Clarke (2008) that "the agility and accessibility provided from wireless devices will further allow M-commerce to differentiate its abilities from E-commerce" [1].

According to Clarke (2008), "commerce transpires as organizations introduce new methods to employ mobile devices to communicate, inform, transact and entertain using text and data via connection to public and private networks" [1]. Schell (2011) indicated that mobile commerce is going to be one of the fastest growing channels or touch points in multichannel sales and marketing. Mobile phone companies continue to update their payment system through the use of M-commerce. Verizon, AT & T Mobility and T-Mobile USA worked together to launch "ISIS" as a mobile payment network. The innovations and the expansion of M-commerce continue to define its market [5].

A lack of research on antecedents to M-commerce intention in a cross-cultural context was a need that Dai & Palvia (2011) tried to address it [7]. They surveyed 89 US college students and 106 residents of large Chinese cities and analyzed ten factors such as Technology Acceptance Model (TAM) and Theory of Rational Action (TRA) that current research suggests would influence intention to use mobile commerce. The factors, which were significantly different between the two countries were perceptions of cost, enjoyment, and subjective norm between China and USA. This contrasted somewhat with the US where perceived enjoyment was emphasized. In the USA, a relation to perceived ease of use was not seen although in China it was. The authors suggested "consumers in low uncertainty avoidance cultures like USA would have more willingness to embrace technology and innovation." The study demonstrated a link between uncertainty avoidance and M-commerce intent, which may suggest a relationship between mobile anxiety and M-commerce intent, provided that there is at least some overlap between uncertainty and anxiety, though this isn't specifically addressed.

How transaction trust impacts users intent to utilize M-commerce and what factors moderate this were studied by Kao (2009). In this study, 250 college students from Australia and Taiwan were surveyed, out of which 112 questionnaires were returned [6]. As suggested by Dai & Palvia (2011), it was determined that M-commerce intent was significantly moderated by uncertainty avoidance [6]. Individualism/collectivism and long-term/short-term orientation were also found to moderate it.

In article by Wu & Wang (2005), a revised version of the TAM that they believed would be able to more accurately determine mobile commerce acceptance was presented and tested [8]. They distributed 850 questionnaires to customers of four companies that provided online transaction services in Taiwan. The completed questionnaires were 310. They found that behavioral intention to use, had a direct effect on actual use. Like USA and unlike China, perceived ease of use did not factor in to usage intent. Factors that did impact mobile intent were perceived usefulness and compatibility that were integrated to create the TAM2 along with the IDT model.

Another study that delved into antecedents to M-commerce intent has been presented by Wei et. al. [9]. The study analyzed the literature and found that several models such as TAM were commonly used to predict M-commerce intent. Using these as a basis, they identified several factors for coming up with a more predictive set. They distributed surveys at mobile phone service provider shops at various shopping malls in Malaysia. They determined that perceived usefulness was found to be significantly predictive of M-commerce intent. In Malaysia, perceived ease of use was not a factor with significant influence on M-commerce intent as was the case in USA and Taiwan but different from China. They found that a factor that other studies had neglected was social influence, which was found to significantly predict M-commerce intent. Also, perceived cost was a barrier that prevented Malaysian M-commerce intent and trust factor was found to be a strong predictor of M-commerce adoption.

The relative lack of attention that mobile anxiety has received compared to computer and Internet anxiety has been addressed by Wang [9]. Wang used computer and Internet anxiety and their points of contact and divergence in the mobile commerce setting to formulate an initial scale. To validate the scale, he gathered data from companies in Taiwan using convenience sampling resulting in 287 usable responses. Wang initially arrived at 44 items and then used experience surveys and personal interviews to add six more. A factor analysis and item deletion eventually resulted in 38 items in seven categories of "learning, Internet use, equipment limitation, job replacement, computer use, computer configuration and Internet stability". These factors were able to explain 65.69% of the variance in the data. He noted that the commonly observed relationship in social cognitive theory is between self-efficacy and anxiety and also between computer anxiety and usage intention. The expectation that this pattern would be consistent for M-commerce, led him to formulate hypotheses and use them for nomological validation [9].

Mobile commerce and perceived risk of security and privacy is one of the main concerns of today's online shoppers. "Consumers are concerned about online payment security, reliability, and privacy policy of the online store" [11, 12]. Park and Kim (2003) study found that a positive relationship exists between information satisfaction and security perception. They also found that "security is a critical factor that can increase customer loyalty toward online shopping" [12]. Wu and Wang (2005) defined perceived risk as "the user's subjective expectation of suffering a loss in pursuit of the desired outcome of using Mobile commerce" and identified it as one of the main factors that impact the behavioral intention of the online shoppers [8].

Bandura (1986) defines self-efficacy as "people's judgments of their capabilities to organize and execute courses of action required to attain designated types of performance" [13]. According to Zhu, Sangwan, and Lu (2010), "self-efficacy implies an internal attribution, it is prospective and

it is an operative construct, which means that cognition is quite proximal to the critical behavior – and thus is a good predictor of actual behavior" [14]. Islam, Khan, Ramayah, and Hossain (2011) found that the self-efficacy has a moderate effect on the adaptation of mobile commerce [15]. Moreover, Wang (2007) stated that the self-efficacy has negative impacts on mobile computer anxiety [10].

Thatcher and Perrewé (2002) have investigated the relationship between the IT-specific characteristics of computer self-efficacy and computer anxiety and stable broad traits such as trait anxiety and negative affectivity [16]. They surveyed 211 students at a large public university in the southwestern United States and noted that "as anxiety grows individuals demonstrate lower levels of Computer Self Efficacy (CSE) and a weaker proclivity to use computers." This is a logical extension of social learning theory, which suggests that as self-efficacy in general sense increases, the corresponding anxiety decreases. The converse holds as well. They also found a direct significant link between trait anxiety and computer anxiety.

The research in computer anxiety subject is well established but there is not much research or attempts to specifically address the relationship between computer anxiety and mobile anxiety.

Computer anxiety and computer self-efficacy are often found to be inversely related as it was the case in Durndell and Haag (2002) study of 74 female and 76 male students from a variety of courses at a Romanian university. The students completed a computer self-efficacy scale, a computer anxiety scale, and an attitude toward the Internet scale. Durndell and Haag found that "higher computer self-efficacy, lower computer anxiety, more positive attitudes toward the Internet and longer reported use of the Internet." However, the Computer Anxiety Rating Scale (CARS) is not only outdated, as it was designed in 1987, but seems to contain many items, which measure only computer anxiety. The other scales seem to have better design [17].

One might speculate that positive attitudes toward the Internet provide a positive factor that influences M-commerce intent. At least, computer self-efficacy and possibly computer anxiety, to the degree that the scale utilized is valid, correlate with Internet attitude, which in turn correlates to Internet usage intent. This suggests that we should investigate how they relate to M-commerce intent.

One concept that relates to M-commerce is the concept of online customer satisfaction and corresponding repurchase intention. Lee, Choi, and Kang (2008) found that this process hadn't been studied thoroughly. They surveyed 200 company employees at a global bank and 200 undergraduate students at a given university. They answered questions regarding specific e-commerce sites with which they were familiar. Then, the study investigated details about how satisfaction with the web site, quality, of service, and other factors were in e-satisfaction [18]. The authors [18] said that "[o]verall e-service quality is shaped by efficiency and fulfillment, with fulfillment playing a particularly important role." They found "that one standard deviation increase in computer anxiety will increase the impact of website information satisfaction on e-satisfaction from 0.30 to 0.45 and one standard deviation decrease in computer self-efficacy will increase the impact of website information satisfaction on efficiency from 0.27 to 0.44." As repurchase intention is a subcategory of M-commerce intention, this causes the question of how these variables affect M-commerce intention at large [17].

Canadian managers and professionals were surveyed to develop and validate a measure of computer self-efficacy and its precursors and results. Although, the study was primarily focused on computer self-efficacy it had a number of findings related to computer anxiety as well. They also observed that "if an individual feels anxious when using a computer, he or she may decide that the reason for the feelings of anxiety is a lack of ability, thus lowering his or her self-efficacy." In the study of "Computer Self-Efficacy: Development of a Measure and Initial Test" by Compeau and Higgins (1995), they perhaps provide a more clear statement of the negative correlation between computer anxiety and computer self-efficacy [19]. This leads us to wonder if there is a similar phenomenon associated with M-commerce devices.

**Problem statement**

In this study, we explore how different factors affect the adoption and usage of Mobile commerce. This is done with consideration to social cognitive factors which are typically predictive and also other factors which may be unique to the M-commerce environment.

**Research Hypotheses**

The research null hypotheses formed based on the factors that might impact mobile commerce adaptation such as mobile anxiety, perceived mobile risk, mobile self-efficacy, level of education and age.

H1: There is no relationship between computer anxiety and mobile anxiety.
H2: There is no relationship between computer anxiety and mobile commerce adoption.
H3: There is no relationship between perceived mobile risk and mobile commerce adoption.
H4: There is no relationship between mobile self-efficacy and mobile commerce.
H5: There is no relationship between income and mobile commerce adoption.
H6: There is no relationship between education and mobile commerce adoption.
H7: There is no relationship between age and mobile commerce adoption.

**Research Methodology**

We used a survey, which had both an online version and a paper version. It was completed by a convenience sample of 99 participants of whom 95 provided useful responses. The participants were mostly students at a large public university in southeastern Michigan. This explains the median age of 20 and the median income of 9600. It is noticed that an age range of 60 and an income range 250,000 indicating that not everyone represented a typical college student demographic. There were 45 female respondents and 49 male respondents. Most participants responded that they had between 1 and 3 years of education after high school but the responses had a range of 15.

The instrument consisted of some initial demographic questions followed by scales to measure computer anxiety, perception of mobile risk, mobile anxiety, mobile self-efficacy, and mobile commerce usage. A five point Likert scale of 1 to 5 was used, where 1 was Disagree, 2 was Slightly Disagree, 3 was Neither Agree/Disagree, 4 was Slightly Agree, and 5 was always.

The scale for computer anxiety with following items was not very reliable as it had a Cronbach's alpha of only 0.603. Perhaps the scale from which we derived the questions was too old to measure this reliably. It is still surprising as it is fundamentally similar to the mobile anxiety scale that was used, which met the standard for validity.

- I feel apprehensive about using computers.
- It scares me to think that I could cause the computer to destroy a large amount of information by hitting a wrong key.
- I hesitate to use a computer for fear of making mistakes that I cannot correct.
- I feel anxious when I have to deal with computers.
- I'm scared of losing my privacy/identity/security when using computers.

The rest of the scales met the minimum 0.7 for validity. As it was mentioned, this includes the mobile anxiety scale in spite of its similarity to the computer anxiety scale. The mobile anxiety scale had a Cronbach of 0.762 and included the following items using the same Likert scale:

- I feel apprehensive about using cell phones, tablets, or PDAs.
- It scares me to think that I could cause cell phones, tablets, and PDAs to destroy a large amount of information by hitting the wrong key.
- I hesitate to use a cell phone, tablet, or PDA for fear of making mistakes that I cannot correct.
- I feel anxious when I have to deal with cell phones, PDAs, or tablets.
- I'm scared of losing my privacy/identity/security when using cell phones, PDAs, or tablets.

The scale for mobile self-efficacy had a Cronbach's alpha of 0.768. It contained the following items using the same Likert scale:

- I would be confident in using cell phones, PDAs, or tablets even if I only had the user manual for reference.
- I would be confident in using cell phones, PDAs, or tablets even if there was no one around to show me how to use them.
- I would be confident in using cell phones, PDAs, or tablets if I had to use a similar one before to do the same task.

Mobile risk was extremely reliable with an alpha of 0.890. It contained the following items using the same Likert scale:

- I think using cell phones, tablets, or PDAs in monetary transactions has potential risk.
- I think using cell phones, tablets, or PDAs in product purchases has potential risk.
- I think using cell phones, tablets, or PDAs puts my privacy at risk.

M-commerce usage also ranked high with 0.878. It contained the following items on a five point Likert scale designed to measure frequency where 1 was never, 2 was seldom, 3 was sometimes, 4 was often, and 5 was always:

- In the past one year, how often did you shop online using a cell phone, a PDA or a tablet?
- In the past one year, how often did you buy music online using a cell phone, a PDA or a tablet?
- In the past one year, how often did you buy books/e-book online using a cell phone, a PDA or a tablet?
- In the past one year, how often did you buy apps/games online using a cell phone, a PDA or a tablet?
- In the past one year, how often did you make purchases from within applications (in app purchases) using a cell phone, a PDA or a tablet?
- I am willing to use a cell phone, PDA or tablet to shop online in the future.

It should be noted that any of the findings related to computer anxiety are highly tenuous due to the lack of reliability of the scale. Thus, no definitive pronouncements on hypotheses H1 and H2 can be made.

**Results**

The correlation analyses of the survey are shown in tables 1-3.

*Table 1: Correlation Analysis for All Participants*

| Null Hypothesis | Pearson Correlation | Sig. (2-tailed) | N | Result |
|---|---|---|---|---|
| (H1) Computer Anxiety → Mobile Anxiety | 0.617** | 0.000 | 95 | Rejected |
| (H2) Computer Anxiety → Mobile commerce | -0.211* | 0.040 | 95 | Rejected |
| (H3) Mobile Risk → Mobile commerce | 0.265** | 0.009 | 95 | Rejected |
| (H4) Self Efficacy→ Mobile commerce | 0.197 | 0.56 | 95 | Failed to reject |
| (H5) Level of Income → Mobile commerce | 0.181 | 0.079 | 95 | Failed to reject |
| (H6) Education → Mobile commerce | 0.000 | 0.999 | 95 | Failed to reject |
| (H7) Age→ Mobile commerce | -0.080 | 0.441 | 95 | Failed to reject |

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

** Correlation is significant at the 0.01 level (2-tailed)

*Table 2: Correlation Analysis for Females*

| Null Hypothesis | Pearson Correlation | Sig. (2-tailed) | N | Result |
|---|---|---|---|---|
| (H1) Computer Anxiety → Mobile Anxiety | 0.628** | 0.000 | 45 | Rejected |
| (H2) Computer Anxiety → Mobile commerce | -0.379* | 0.010 | 45 | Rejected |
| (H3) Mobile Risk → Mobile commerce | 0.234 | 0.122 | 45 | Failed to reject |
| (H4) Self Efficacy→ Mobile commerce | 0.435** | 0.003 | 45 | Rejected |
| (H5) Level of Income → Mobile commerce | 0.143 | 0.350 | 45 | Failed to reject |
| (H6) Education → Mobile commerce | 0.165 | 0.279 | 45 | Failed to reject |
| (H7) Age→ Mobile commerce | -0.280 | 0.53 | 45 | Failed to reject |

* Correlation is significant at the 0.05 level (2-tailed)
** Correlation is significant at the 0.01 level (2-tailed)

*Table 3: Correlation Analysis for Males*

| Null Hypothesis | Pearson Correlation | Sig. (2-tailed) | N | Result |
|---|---|---|---|---|
| (H1) Computer Anxiety → Mobile Anxiety | 0.578** | 0.000 | 49 | Rejected |
| (H2) Computer Anxiety → Mobile commerce | -0.017 | 0.909 | 49 | Failed to reject |
| (H3) Mobile Risk → Mobile commerce | 0.288** | 0.045 | 49 | Rejected |
| (H4) Self Efficacy→ Mobile commerce | -0.026 | 0.850 | 49 | Failed to reject |
| (H5) Level of Income → Mobile commerce | 0.411** | 0.003 | 49 | Failed to reject |
| (H6) Education → Mobile commerce | 0.068 | 0.642 | 49 | Failed to reject |
| (H7) Age→ Mobile commerce | 0.049 | 0.737 | 49 | Failed to reject |

* Correlation is significant at the 0.05 level (2-tailed)
** Correlation is significant at the 0.01 level (2-tailed)

As computer anxiety is often predictive of computer usage in general, it is interesting to determine whether it would also be predictive of mobile commerce usage. In testing H1, it was found that the Pearson's R was -0.211, meaning that 4.4% of the variance in mobile adoption was explained by this variable. The finding was significant. It was moderated by gender. The relationship was only significant for women. Unfortunately, since our computer anxiety scale was unreliable this conclusion is untrusted.

One question that sufficiently isn't addressed in the literature is the degree to which computer anxiety and mobile anxiety were separate concepts. In testing H2, we found that there was a significant overlap between the two with a Pearson's R of 0.617, meaning that 38% of the variance in mobile anxiety was explained by computer anxiety. This was not moderated by gender. Again, it should be noted that the computer anxiety scale used was unreliable and so this finding is untrusted.

It is interesting to know what factors specific to mobile commerce might be predictive of its adoption above and beyond generic concepts such as self-efficacy and anxiety, which are related concepts for computer usage in general and for general psychology. In testing H3, a significant negative correlation between mobile risk and mobile adoption was found. This correlation was moderated by gender and was only significant for males.

One place where the literature indicated we should expect to find a relationship was between mobile self-efficacy and M-commerce. In testing H4, we did not find this relationship. However, we found that gender moderated that result and that there was a significant relationship between mobile self-efficacy and mobile commerce adoption for females.

Several demographics including income, education, and age were tested, but it was determined that none of these had a significant impact on mobile commerce adoption. However, it was found that the relationship between income and mobile commerce adoption was moderated by gender and that the relationship was significant for men. A Pearson's R of 0.411, meant that for men income explained 17% of the variance in mobile adoption.

## Conclusion

The analysis of the collected data from the survey suggests relationships between computer anxiety and mobile commerce adoption, between mobile risk and mobile commerce adoption, between mobile self-efficacy and mobile commerce, between computer anxiety and mobile anxiety, and between income and mobile commerce adoption. The gender exerted a moderating influence in ways that weren't predictable. Computer anxiety, mobile self-efficacy and income were found to be predictive of mobile commerce adoption only for females whereas mobile risk was only predictive of mobile commerce adoption for males. The first two hypotheses of this work produced the results that were expected, but the scale for computer anxiety wasn't reliable. It is interesting to test them again with a different and valid scale.

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