Should Questionnaires of Innovation Acceptance Models Be Questioned?

By Basak Argun

B.A. in Industrial Engineering, June 2008, Kocaeli University

A Thesis Submitted

To the Faculty of

The School of Engineering and Applied Science
of The George Washington University
in partial fulfillment of the requirements
for the degree of Master of Science

August 31, 2012

Thesis directed by

E. Lile Murphree
Professor of Engineering Management and Systems Engineering

Dedication

This master's thesis is dedicated to my family, who has been giving limitless support to me during my life journey. To my mother, Fikriye Argun, if you did not teach me how to believe in myself and follow my dreams, I would not be writing these words. To my father, Mustafa Argun, I would not be able to accomplish this thesis without your heart-warming words. To my sister, Burcak Argun, although there were 5267 miles between us, I always felt your arm on my shoulder. Whenever I needed your voice, you were far away from me just one Skype Call without considering the time difference. Finally, to Safa Cetinguc, I would not know what I would do without your unconditional encouragements.

I am blessed to be around all of you.

Acknowledgements

I thank my master's thesis director, Dr. E. Lile Murphree for his insight, encouragement, and patience. He has been not only my advisor; he has also been my mentor. Whenever I feel myself in a dead end road, he helped me out.

I also thank my other two thesis committee members, Dr. Howard Eisner and Dr. Michael Stankosky, for their guidance and assistance.

Abstract of Thesis

Should Questionnaires of Innovation Acceptance Models Be Questioned?

The goal of this research was to examine the quality of questionnaires of innovation models. This inquiry is important because acceptance rates of innovations are measured by innovation acceptance models, and the quality of questionnaires of innovation acceptance models affects the reliability of results.

Five different innovation acceptance models, including Theory of Reasoned Action (Fishbein and Ajzen, 1975), Theory of Planned Behavior (Ajzen, 1991), Technology Acceptance Model (Davis, 1989), Unified Theory of Acceptance and Use of Technology (Venkatesh, Morris, Davis, & Davis, 2003), and Innovation Diffusion Model (Rogers, 1995) were used for this research. Derived from five different innovation acceptance models, thirty-one dissertations were examined. Dissertation questionnaires were evaluated if the questionnaires address the core constructs of innovation acceptance models and the questions of questionnaires include wording that might affect the response of participants.

The results of the study showed that although questionnaires of innovation acceptance models address the core constructs of the model, they do not include impartial wording in their questions with high percentage.

Table of Contents

CHAPTER PAGE

List of Figures

List of Tables

Chapter 1: INTRODUCTION

From the beginning of human life, human beings have been inventing products, technologies, and services to fulfill their needs. In this high technology era with high demands and expectations of customers, innovation is the key element for continued existence. Dyer, Gregersen and Christensen stated "innovation is the lifeblood of our global economy and a strategic priority for virtually every CEO of the world" (2011, p.1). If innovation is essential in today's life, what is innovation? Rogers explained innovation as "an innovation is an idea, practice or object that is perceived as new by an individual or other unit of adoption" (2003, p.12). Innovation does not necessarily mean doing a new thing; it also means doing things in a different and new way. Moreover, perception of the adopter plays an important role in the decision process. Although the product, the service or the idea has been on the market, if it seems new to the individual in terms of knowledge, persuasion or a decision to adopt, it is an innovation (Rogers, 2003). Even though the latest innovation in the industry has offered superior advantages, the end user might not adopt the innovation. For instance, despite the fact that the Dvorak keyboard is much more efficient and ergonomic than the QWERTY keyboard, almost no one adopted the Dvorak keyboard, although it has been more than 75 years since the Dvorak keyboard was launched (Rogers, 2003). On the other hand, there are other examples that surprised innovators. As an illustration, when Tom Tom GO was launched in March 2004, its sales target was 800,000 after 1 year, yet the actual sales was 1.5 million after 1 year (Chiesa & Frattini, 2011). A good number of research studies from different backgrounds such as social physiology (Ajzen & Fishbein, 1980), information technology (Davis, 1989), and

marketing (Mahajan, Muller & Bass, 1990) have been done in order to understand and explain how and why people decide to accept the innovations. Woodside and Bieamans proposed a model called Innovation-Manufacturing-Diffusion-Adoption/Reject (IMDAR); in this model the acceptance process consists of diffusion and adoption/rejection (2005). Diffusion is not only about the innovation itself; it is about the whole environment. Rogers defined diffusion as "the process by which an innovation is communicated through certain channels over time among the members of a social system" (2003, p.11). On the other hand, adoption or rejection is a decision-making process (Woodside and Bieamans, 2005).

This research study is based on applications of five different innovation acceptance models: Theory of Reasoned Action (Fishbein and Ajzen, 1975), Theory of Planned Behavior (Ajzen, 1991), Technology Acceptance Model (Davis, 1989), Innovation Diffusion Model (Rogers, 1995), and Unified Theory of Acceptance and Use of Technology (Venkatesh, Morris, Davis & Davis, 2003). When researchers applied these theories to their technologies, they used questionnaires to understand the reactions of customers. In this research, the researcher is looking for the quality of the questions of the questionnaires.

1.1 Problem Statement

Researchers have been conducting a great deal of research for more than 30 years about acceptance of innovations. Since human factors are the main objective, many researchers have been using questionnaires. Babbie explained that questionnaires have been used in survey researches as well as field research, experiments and other data collection activities (2010). Thus, many researchers evaluate the acceptance of

innovation rate through questionnaires. Yet there are not any evaluation criteria for those questionnaires to control if they give objective data as it is known that “an improperly laid out questionnaire can lead respondents to miss questions, confuse them about the nature of the desired, and even lead them to throw the questionnaire away” (Babbie, 2010, pg. 262).

Richard Harris did an experiment with 46 undergraduate students; he asked students to make a numerical assumption to questions that include marked or unmarked quantifiers (1973). He presented a report to show that how modifiers affect the results (Harris, 1973). Table 1 shows some examples from Harris’s report.

As is seen from Table 1, responses vary according to wording of the questions. Innovation acceptance model researchers’ questions might need to be questioned.

Questions and Units of Measure	Questions	Modifier	Mean
	How.... time did the man have between planes? (Min., hr.)	Much Little	73.2 min 37.5 min
	How … was the man's attic? (°F)	Hot Cold	92.9 °F 37.0 °F
	How … did the family go to their cottage? (Day, wk., mo., yr. intervals)	Often Seldom	20.2 times/yr. 7.0 times/yr.
	How … was the city hall? (yr.)	Old Short	77.7 yr. 13.9 yr.
	How … does that professor give an exam? (Day, wk., mo., yr. intervals)	Frequently Infrequently	3.02 wk. 3.86 wk.
	How … was the crowd at the football game? (People)	Big Little	28,898 people 10,533 people

Table 1 Harris's Test Questions and Analysis of Responses (Harris, 1973)

1.2 Purpose of the Study

The purpose of this study is to examine questions of questionnaires of innovation acceptance models. The main concern of this study is if the researchers of application of these models pay enough attention when they construct their questionnaires due to the fact that questionnaires not constructed objectively might bias the participants' responses.

1.3 Main Research Question

As is seen in the title, the main question is "should questionnaires of applications of innovation acceptance models be questioned?" If they should be questioned, what are the reasons to question them? What factors might affect the questionnaires were the starting point of the research. The researcher believed that questionnaires of innovation acceptance models have two components: innovation models and humans. For innovation models' perspective the research question is: "Do the questionnaires sufficiently address the parameters of the respective models of diffusion and adoption of innovations?" Also for human factor perspective, the research questions are: "Are the questions structured so as to get impartial responses from participants?" and "If they are not, what kind of factors might affect the responses of the participants?"

1.4 Organization of the Document

This thesis follows a logical path through four chapters. The first chapter is the introduction part of the document. In this chapter, the researcher explains what the research includes, how and why she is interested in this topic. The second chapter reviews the pertinent literature about the selected innovation acceptance models and how questionnaires should be constructed. The third chapter is about the model that is used in this research. The last chapter is about findings and conclusions of the research.

CHAPTER 2 LITERATURE REVIEW

2.1 Adoption Models

In this research five different innovation acceptance models have been used. These models are Theory of Reasoned Action (Fishbein and Ajzen, 1975), Theory of Planned Behavior (Ajzen, 1991), Technology Acceptance Model (Davis, 1989), Innovation Diffusion Model (Rogers, 1995), and Unified Theory of Acceptance and Use of Technology (Venkatesh, Morris, Davis & Davis, 2003).

2.1.1 Theory of Reasoned Action (TRA)

Ajzen and Fishbein's (1975) proposed theory of reasoned action is one of the most popular theories used to predict consumer intentions and behaviors in a wide range of a variety of subjects. In the literature there are a good number of applications of TRA such as purchasing products like toothpaste (Ryan, 1982), soft drinks (Warshaw, 1980b), and coupon usage (Bagozzi, Baumgartner & Yi, 1992; Shimp & Kavas,1984).

"TRA posits that behavioral intentions, which are the immediate antecedents to behavior, are a function of salient information or beliefs about the likelihood that performing a particular behavior will lead to a specific outcome" (Madden, Ellen & Ajzen, 1992).

Ajzen and Fishbein stated, "According to the theory of reasoned action, a person's intention is a function of two basic determinants, one personal in nature and the other reflecting social influence" (1980, p. 6).

The first determinant is *attitude toward behavior*, which basically refers to the individual's personal evaluation of performing the behavior (Ajzen and Fishbein, 1980). "A person's attitude toward behavior is proposed to be a function of the perceived consequences of performing that behavior and of the person's evaluation of those consequences" (Fishbein & Ajzen, 1975, p.301). The second determinant *subjective norm* is basically the individual's perceptions and evaluations according to what other people think if the individual performs the behavior (Fishbein & Ajzen, 1975). It is simply social pressure on the individual's judgment of behavior. According to the theory, "subjective norms are determined by the perceived expectations of specific referent or groups, and by the person's motivation to comply with those expectations" (Fishbein & Ajzen. 1975, p. 302).

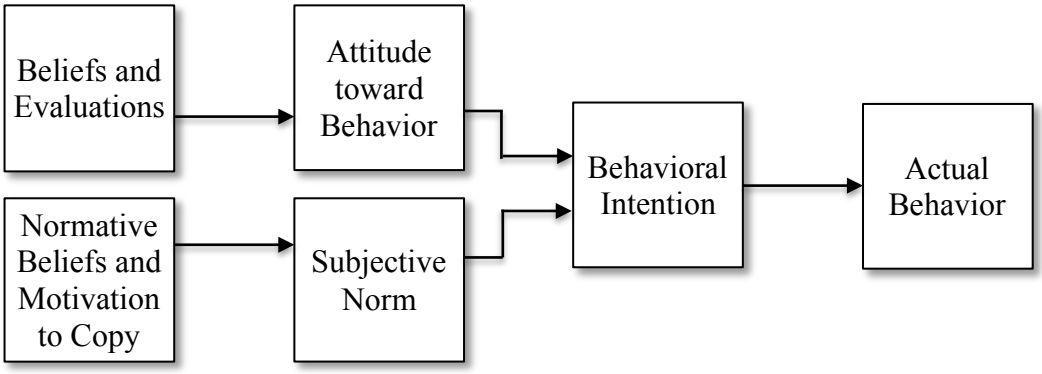

Figure 1 Theory of Reasoned Action (Fishbein & Ajzen, 1975)

Davis et al. stated, "TRA mediates the impact of uncontrollable environmental variables and controllable interventions on user behavior" (1989). Thus, it shows that TRA is a very convenient model to study behaviors within the organization. Due to

the fact that regulations in the organization or orders from their superiors, individuals might not decide whether to accept or not innovations with their feelings and beliefs. Perceived control is a missing part of this model. While Sheppard et al. (1988) reported an analysis of TRA's predictive utility and stated that there is strong support for it, Davis et al. (1989) stated that the weight of the subjective norm is not as much as attitude toward behavior.

2.1.2 Theory of Planned Behavior (TPB)

As the Theory of Reasoned Action (TRA) began to take hold in social science, Ajzen and other researchers realized that this theory was not adequate and had several limitations (Godin and Kok, 1996). The Theory of Planned Behavior (TPB) is an extension to the TRA theory that was weak in predicting people's behavior when they have incomplete volitional control (Ajzen and Fishbein, 1980). Moreover, it is important that "…behavior intention can find expression only if the behavior in question is under volitional controls" (Ajzen, 1991).

Ajzen claims that behavioral achievement is a joint function of behavioral control (ability) and behavioral intention (motivation) (Ajzen, 1991). It is assumed that behavioral intention and perceived behavioral control interact with each other.

As in the Theory of Reasoned Action, intentions are the central factor to perform a given behavior; basically an individual will perform the behavior if he/she intends to do so, or if he/she does not intend to do so he/she will not perform that behavior (Ajzen, 2006). As is seen in Figure 2, attitudes, social norms and perceived behavioral control are determinants of intention.

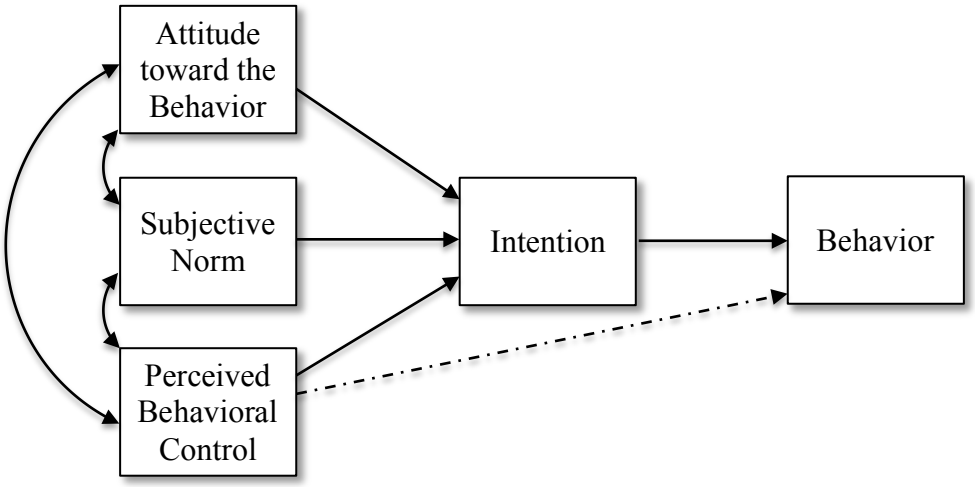

Figure 2 The Theory of Planned Behavior (Ajzen, 1991)

Attitudes include beliefs about the positive and negative outcomes of the behavior as well as the person's evaluation of those outcomes (Ajzen, 1991). Subjective norms refer to the individual's perceptions about what important others think about the given behavior and the individual's motivation to fulfill the perceived expectations of important others (Fishbein & Ajzen. 1975). For instance, a person has a job offer from another city; she evaluates her decision according to her perceived wishes of her important others. She does not take the job, because she thinks that if she takes the job, her family will not welcome her decision. Last but not least, perceived behavioral control (PBC) plays an important role in TPB while directly affecting intention and behavior. PBC distinguishes TPB from TRA with adding personal control measurement to the model. Quine et al. state that "perceived behavioral control is underpinned by control beliefs about perceptions of obstacles, impediments, skills,

resources and opportunities that may inhibit or facilitate performance of the behavior" (2001).

2.1.3 Technology Acceptance Model (TAM)

Technology Acceptance Model by Davis was derived from Fishbein and Ajzen's (1975) Theory of Reasoned Action model and introduced to test new end-user information systems in his dissertation (1986). TAM proposes that actual system use is determined by behavioral intention, which is jointly determined by the person's attitude toward using the system and perceived usefulness (Davis et al., 1989).

Davis's model is focused on two theoretical constructs: perceived usefulness and ease of use, and their relations between system characteristics (external variables). Davis explains perceived usefulness, as "the degree to which a person believes that using a particular system would enhance his or her job performance" (1989). Also he explains that perceived ease of use is "the degree to which a person believes that using a particular system would be free of effort" (Davis, 1989).

Moreover, he claimed that if the system were easier to use, it would be more useful (Davis, 1989). Thus, perceived ease of use directly affects perceived usefulness and attitude toward using it as is seen in Figure 3.

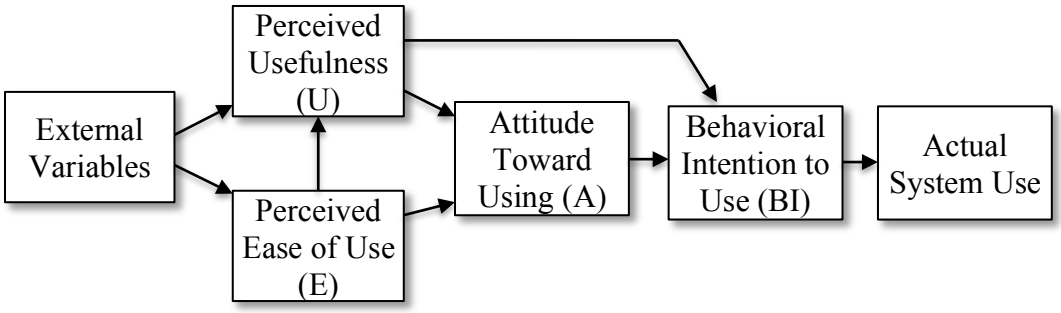

Figure 3 Technology Acceptance Model (Davis, 1989)

A great number of applications of TAM have been conducted after Davis proposed this model. For instance, Adams, Nelson and Todd applied Davis' work to test the validity of the ease-of-use and usefulness scale using samples from various kinds of technologies (1992). They conducted two different studies; the first one examined the relationships among ease of use, usefulness and usage of two different kinds of messaging technologies (electronic mail and voice mail); the second one examined perceptions of three microcomputer software packages that are very similar to each other (1992). Both studies affirmed the validity and reliability of the ease-of-use and usefulness scales (Adams et al., 1992).

Moreover, Szajna (1994) conducted research on usage of database management systems and the study showed the validity and reliability of TAM on acceptance of software packages.

Davis, in the original version of TAM, excluded social norms from TRA because he estimated that social norms have insignificant effect on behavioral intention (Davis et al., 1989). However, Warshaw stated in his research that social norms might

influence behaviors via attitudes indirectly (1980a). Davis proposed a new version of Technology Acceptance Model (TAM2), which includes subjective norms (Legris et al., 2003). This is not the only extension of TAM. Researchers added constructs according to their fields to get more reliable results. For instance, Igbaria, Guimaraes and Davis (1995) conducted research on microcomputer usage with an extended version of TAM. Also Jackson, Chow and Leitch (1997) proposed another extension of TAM. Suggesting that perceived ease of use has a direct relationship with behavioral intention, they added user involvement and physiological indicators to their model.

Additionally, there are proposed integrated models based on TAM, such as Training Environment Model (Venkatesh, 1999), and Motivational Model (Venkatesh & Speier, 1999).

2.1.4 Diffusion of Innovation (DoI)

Everett Rogers got interested in the Diffusion of Innovation model after his observations on farmers in Carroll, Iowa, who postponed accepting agricultural innovations (1995). DoI systematically explores the diffusion of innovation by a well-defined decision of innovation process. Rogers believes that a multi-disciplined approach should be applied to understand the diffusion of innovation (2003). Only anthropology or sociology never is enough to see the whole concept of diffusion: geography, education, marketing and management should be considered. Rogers explains that “An innovation is communicated through certain channels over time among the members of a social system” (2003, p.11).

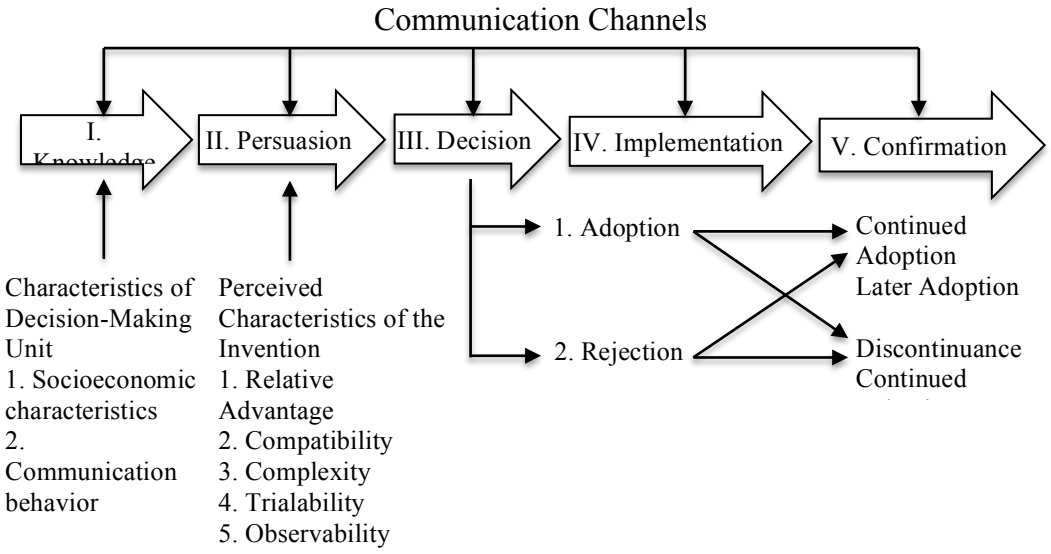

Figure 4 The Innovation Decision Process (Rogers, 2003, p.170)

By examining individuals in different categories based on their tendency to adopt an innovation, the innovation decision-making model follows a decision making process which is affected by internal and external factors.

The knowledge stage is about creating awareness of an innovation. Individuals gain the basic knowledge about the innovation and simply find answers for what the innovation is, how it works and why it works. At this stage, individuals' socioeconomic status, personal characteristics and communication behavior play important roles.

According to Rogers, at the persuasion stage, individuals start seeking information about the innovation, and their attitude toward the innovation begins to be formed. Moreover, individuals have different perceptions on the characteristics of innovation, and these perceptions help to explain the different rates of adoption

(Rogers, 2003). According to Rogers, There are 5 perceived characteristics of the innovation:

1) "Relative Advantage: The degree to which an innovation is perceived as better than the idea it supersedes" (2003, p. 229).
2) "Compatibility: The degree to which an innovation is perceived as consistent with the existing values, past experiences, and needs of potential adopters" (2003, p. 240).
3) "Complexity: The degree to which an innovation is perceived as difficult to understand and use" (2003, p. 257).
4) "Trialability: The degree to which an innovation may be experimented on a limited basis" (2003, p. 258).
5) "Observability: The degree to which the results of an innovation are visible to others" (2003, p. 258).

Moore and Benbasat added three more characteristics to this list to increase the comprehensibility of innovations (1991).

6) Image: "The degree to which use of an innovation is perceived to enhance one's image or status in one's social system" (Moore and Benbasat, 1991, p. 195).
7) Results Demonstrability: "The tangibility of the results of using the innovation, including their observability and communicability" (1991, p. 203).
8) Voluntariness of Use: "The degree to which use of the innovation is perceived as being voluntary, or of free will" (1991, p. 203).

At the decision stage, individuals decide to adopt or reject the innovation based on their evaluations. Neither adoption nor rejection means that this attitude will be permanent. Individuals may change their decision after they decide to adopt or reject it.

The Implementation stage is the step where individuals decide if their attitude will be permanent. At the last stage, after the experience individuals have with the innovation, they confirm if they adopt or reject it.

2.1.5 Unified Theory of Acceptance and Use of Technology (UTAUT)

Venkatesh et al. reviewed eight notable acceptance models. They formulated UTAUT after reviewing these models to assess the likelihood of a new technology acceptance and factors that influence the adoption of the new technology. (2003). These models are Theory of Reasoned Action (Fishbein & Ajzen, 1980), Theory of Planned Behavior (Ajzen, 1985), Technology Acceptance Model (Davis, 1989), Motivational Model (Davis et al., 1992), a model combining Technology Acceptance Model and Theory of Planned Behavior (Taylor & Todd, 1995), Innovation Diffusion Theory (Rogers, 1995), and Social Cognitive Theory (Venkatesh et al., 2003).

Venkatesh and his scholars followed four steps to conduct this research. The first step was reviewing these eight acceptance models of innovations to understand the current knowledge about the topic. Venkatesh and his scholars examined the core construct of each model.

Models	Core Constructs
Theory of Reasoned Action (Fishbein & Ajzen, 1980) (TRA)	Attitude Toward Behavior
	Subjective Norm
Theory of Planned Behavior (Ajzen, 1985) (TPB)	Attitude Toward Behavior
	Subjective Norm
	Perceived Behavioral Control
Technology Acceptance Model (Davis, 1989) and Technology Acceptance Model 2 (Venkatesh & Davis, 2000) (TAM)	Perceived Usefulness
	Perceived Ease of Use
	Subjective Norm
Motivational Model (Davis et al., 1992) (MM)	Extrinsic Motivation
	Intrinsic Motivation
Model of PC Utilization (Thompson et. al, 1991) (MPCU)	Job-fit
	Complexity
	Long-term Consequences
	Affect Towards Use
	Social Factors
	Facilitating Conditions
A model combining Technology Acceptance Model and Theory of Planned Behavior (Taylor & Todd, 1995) (C-TAM-TPB)	Attitude Toward Behavior
	Subjective Norm
	Perceived Usefulness
	Perceived Ease of Use

Innovation Diffusion Theory (Rogers, 1995; Moore & Benbasat, 1991) (DoI)	Relative Advantage
	Ease of Use
	Image
	Visibility
	Compatibility
	Results Demonstrability
	Voluntariness of Use
Social Cognitive Theory (Venkatesh et al., 2003) (SCT)	Outcome Expectations-Performance
	Outcome Expectations-Personal
	Self-efficacy
	Affect
	Anxiety

Table 2. Models and Theories of Individual Acceptance (Venkatesh et al., 2003)

Then, they checked the role of moderators (experience, voluntariness, age and gender) in existing models; if models include moderators, they analyzed their role. Finally, they reviewed model comparison studies in the literature.

The second step was empirically comparing these eight models based on predicting intention in two different kinds of use (mandatory and voluntary) that was experimented with based on independent variables of each model (Venkatesh, 2003). The data was collected from different points in the training time period. Venkatesh and his colleagues examined the data from different environments from different time periods, compared and contrasted the results and suggested UTAUT as the third step of the experiment (Venkatesh, 2003). This model basically provides a useful tool for understanding the key drivers of the acceptance of innovations.

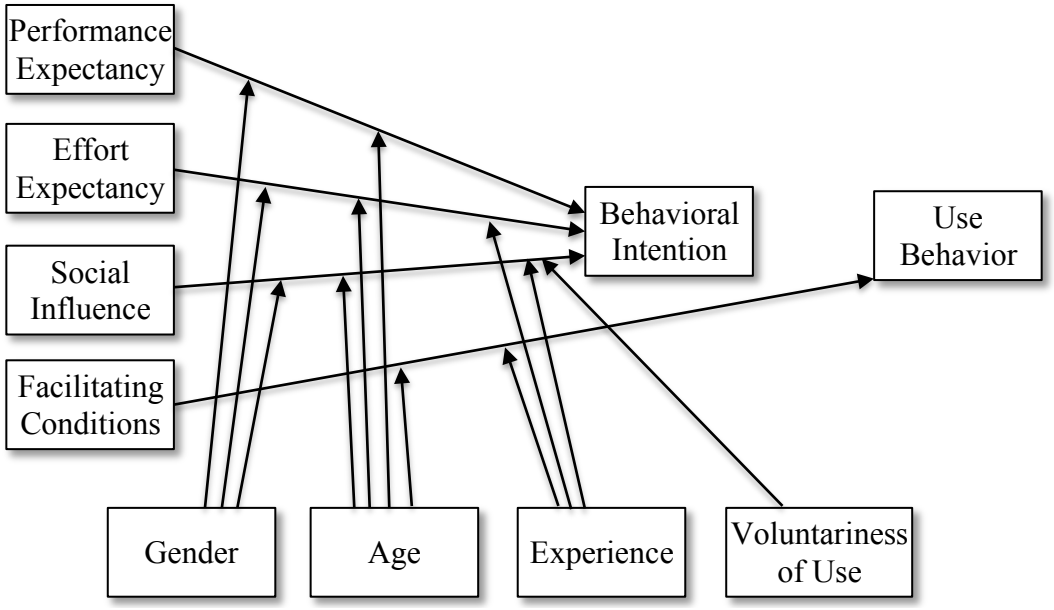

Figure 5 Unified Theory of Acceptance and Use of Technology (Venkatesh Morris, Davis, & Davis, 2003)

As is seen from Figure 5, the UTAUT model has four core components of intention and usage (performance expectancy, effort expectancy, social influence, and facilitating conditions) and up to four moderators of key relationships (gender, age,

experience and voluntariness of use) (Venkatesh et al., 2003). Venkatesh et al. defined performance expectancy as, "the degree to which an individual believes that using the system will help him increase job performance" (2003). Performance expectancy is derived from perceived usefulness (TAM and C-TAM-TPB), extrinsic motivation (MM), job-fit (MPCU), relative advantage (DoI), and outcome expectations (SCT) (2003). Gender and Age are the moderators of performance expectancy as is seen in Figure 5. Effort Expectancy is defined as "the degree of ease associated with the use of the system", and its root constructs are perceived ease of use (TAM/TAM2), complexity (MPCU) and ease of use (DoI) (2003). Gender, age and experience are the moderators of this variable. Moreover, Social Influence is captured from subjective norm (TRA, TPB, TAM2 and C-TAM-TPB), social factors (MPCU), and image (DoI), and defined as "the degree to which an individual perceives that important others believe he or she should use the system" (2003). Performance expectancy, effort expectancy and social influence are the direct motivators of behavioral intentions. Facilitating conditions, defined as "the degree to which an individual believes that an organizational and technical infrastructure exists to support use of the system" affect usage directly (2003).

The last step was empirically examining validation of the model (Venkatesh et al., 2003). Preliminary and new results strongly supported that UTAUT is a reliable model to be a guide for acceptance and use of technology (2003).

As expected, researchers have applied and integrated UTAUT in various kinds of fields to study acceptance and use of technologies such as tablet PCs (Garfield, 2005),

short message services (Baron et al., 2006), mobile services (Koivumäki et al., 2008), and social media (Curtis et al., 2010).

2.2 Questionnaires

The purpose of questionnaires is gathering data via asking questions or asking respondents to agree or disagree with statements representing different perspectives (Babbie, 2001). In *The Art of Asking Questions*, Payne stated that asking the right questions that provide valid and reliable information for making decisions as well as testing a theory is probably as much an art as the other aspects of research (1951). Peterson claimed that the data gathered from questionnaires might be useless if a researcher does not ask the right question in the right way even though the other aspects of the research is well designed; even worse, the wrong data might lead the researcher in a wrong direction (2000).

Kinnear and Taylor claimed, "Questionnaire design is more an art form than a scientific undertaking. No steps, principles, or guidelines can guarantee an effective and efficient questionnaire" (1996, p. 355). However, Peterson (2000) suggested a 7 step-framework for constructing questionnaires. These steps are

- Review information requirements of the problem, opportunity, or decision to be made
- Develop and prioritize a list of potential research questions to provide the required information
- Evaluate each potential research question to see if participants can understand, can answer and will answer the questions

- Determine types (open-end and/or closed-end) of questions to be asked
- Decide on specific wording of each question to be asked
- Determine questionnaire structure
- Evaluate questionnaire (Peterson, 2000, p.14)

Reviewing information requirements of the problem is crucial for the validity of questionnaires. Peterson explained, “unless a researcher understands the information requirements - what information is needed and how that information will be used - no attempt should be made to construct a questionnaire. The effort would be a waste of time for the researcher and the results would be of little value" (2000, p. 15). Kinnear and Taylor also suggested that a researcher must have a detailed listing of the informational needs (1996).

After reviewing the required information of the problem, the next step is developing and producing questionnaires. The researcher should ask specific questions in order to better translate information from answers to useful data for the problem. Only relevant questions to the subject should be asked of participants (Brace, 2008). While developing questions, the researcher should consider if the participant would be able to understand and provide the answer to the question, also if the participant is willing to answer the question (Kent, 1993). The fourth step is choosing the type of questions. There are several ways to classify questionnaires, such as open-ended or closed-ended, spontaneous or prompted, open-ended or pre-coded questions (Brace, 2008). In this framework, open-ended and closed-ended questions have been studied. Open-ended questions have been used when the researcher expects participants to answer the questions with their own words.

Sometimes, participants answer questions with irrelevant information. Additionally, the researcher must be very careful while interpreting the answers of participants. On the other hand, closed-ended questions narrow down the participant's answers; they require the participant to choose an answer out of pre-determined specific choices (multiple choice or rating scales). Preparing closed-ended questions takes much more time than open-ended questions, while completing closed-ended questionnaires takes a shorter time.

Schuman and Scott conducted experiments about "the most important problem facing this country today" and examined answers of open-ended and closed- ended questions (1987). First they asked 178 participants "What do you think is the most important problem facing this country today?" and asked 171 participants "Which of the following do you think is the most important problem facing this country today- the energy shortage, the quality of public schools, legalized abortion, or pollution- or if you prefer, you may name a different problem as important" (1987). They collected the data in Table 3.

Problems	Percentage Choosing Each Answer	
	Open-Ended Questions	Closed-Ended Questions
Quality of Public Schools	1.2	32.0
Pollution	1.2	14.0
Legalized Abortion	0	8.4
Energy Shortage	0	5.6
Don't know	4.7	0.6
All other Responses	93.0	39.3

Table 3. Schuman and Scott's experiment results (1987)

Moreover, Plous (1993) gave another example from Schuman and Scott's experiment about the most important world event. When participants chose answers from given choices, 30 percent of them chose "computer"; on the other hand, when they were asked open-ended questions, just 2 percent of participants mentioned computer (Schuman & Scott, 1987). These experiments show that the type of questions affect participants' responses.

After deciding the type of questions, wording of the questionnaires is the next step. While writing a questionnaire, it is the researcher's duty to construct understandable and objective questions for respondents. Using difficult language, ambiguous or influential quantifiers results in getting wrong or no responses from the participant. In the literature, there are plenty of studies that examined the wording

effect of questions. In Chapter 1, Harris's experiment was given as an example of why there might be a need for questioning questionnaires of innovation models. In Harris's study (1973) the only thing changed was adjectives or adverbs; in fact, there are other kinds of examples to demonstrate the wording effect of questions, such as the language used in the questions, having ambiguity in the questions or choices, using influential quantifiers. Brace mentioned that sometimes there might be an assumption that participants understand the terms as researchers do; in fact the participants might not answer the questions the researcher asked; they will answer what they think is being asked (2008). If technical terms have been used, definitions must be provided.

Additionally, ambiguous wording effect is another well-known error type in questions. If an ambiguous question is asked of the participant, the participant might not know what to answer. Brace (2008) gave an example of this problem: the researcher asked respondents "Do your parents work full time?" and answer choices are yes and no. It seems that this question is very simple, yet if the participant's dad works full time and mother works part time or vice versa, what should the answer be? Moreover, what "full-time work" means might differ from country to country; there should be a definition of it. Brace suggested that the right question should ask "Do either or both of your parents work full time, that is, more than 30 hours a week?" and answer choices should be both, one and neither (2008). Moreover, frequency scales affect participants' answers. Schwarz et al. conducted studies on participants' answers to low and high frequency scale questions (1985). The experiment was about how many hours the participant watches TV in a day; the results were different when they

used different scales (low and high frequency scales) that range in half-hour steps (1985). The low frequency scale started from up to a half hour and it ended up more than two and half hours; on the other hand, the high frequency scale started up to two and half hours and it ended up more than four and a half hours (1985). As is seen from Table 4, the results are different from each other. When the high frequency scale was given, the estimated TV use is 3.2 hours, whereas, when the low frequency scale was given, the average estimated time is 2.7hours (1985).

Low Frequency Range		High Frequency Range	
Up to ½ h	7.4 %	Up to 2 ½h	62.5 %
½ h to 1h	17.7 %	2 ½h to 3h	23.4 %
1h to 1 ½h	26.5 %	3h to 3 ½h	7.8 %
1 ½h to 2h	14.7 %	3 ½h to 4h	4.7 %
2h to 2 ½h	17.7 %	4 to 4 ½h	1.6 %
More than 2 ½h	16.2 %	More than 4 ½h	0.0 %

Table 4. Function of Category Change (Schwarz et al., 1985)

Additionally, Schwarz and his colleagues studied the effects of scales with numbers. They conducted an experiment by using two different numeric scales to ask respondents “How much successful have you been in life, so far?” (1991). The first scale ranged from 0 to 10 whereas the second scale arranged from -5 to 5.

Respondents were given an explanation about numeric scales in the beginning of the questionnaire: 0 and -5 meant not at all successful while 10 and 5 meant extremely successful (1991). The results were not the same again, as the low-high category scales mentioned above. On the -5 to 5 scale 34% of the respondents chose a value between -5 and 0, while only 13% of the responses were between 0 and 5 on 0 to10 scale (1991). Schwarz explained these results with these words: "In general, a format that ranges from negative to positive numbers conveys that the researcher has a bipolar dimension in mind, where the two poles refer to the presence of opposite attributes. In contrast, a format that uses only positive numbers conveys that the researcher has a unipolar dimension in mind, referring to different degrees of the same attribute" (1999). From the respondents' perspective, using numeric scales might cause ambiguity.

Moreover, using influential quantifiers affects the answers of respondents. As is seen in Table 1, using a different adjective or adverb in asking the same question collects different results. Loftus and Palmer made an experiment on participants' responses by asking the same question with different words (1974). They asked participants "About how fast were the cars going when they smashed into each other?" and the response of estimated speed was higher when "smashed" was replaced by "collided", "bumped" or "hit" (1974). In this experiment, respondents thought that they should estimate a higher number when "bumping" or "collision" speed was asked. Examples showed that constructing questionnaires is very sensitive and researchers must consider the importance of wording of the questionnaire.

Chapter 3. METHODOLOGY

3.1 Restatement of the Problem

The goal of this research is to examine questionnaires of innovation acceptance models. Researchers conduct surveys to evaluate validity of their models. The problem is how they can be sure that their evaluation criteria, which are questionnaires, will give reliable data to the researchers. The main research question of this study is "Should questionnaires of innovation acceptance models be questioned?" There were not any evaluation criteria for validity and/or reliability of data found. As is seen from Table 1, responses vary enormously when just one word has changed. Moreover, even asking the same question with different rating scales affects the responses, as is shown in Table 4. There are many other examples to show how responses differ via wording effect. Human factors carry a crucial role for innovation acceptance models and questionnaires since the questionnaires of these models are conducted on humans.

The second question is if questionnaires of innovation models should be questioned, what are the reasons to question them? After reviewing literature based on research studies on wording effects of questions, how an effective questionnaire should be constructed was examined. According to Peterson, effective questionnaires should include brief, relevant, unambiguous, specific and objective questions based on the researchers' knowledge of the model (2000). Also Kinnear and Taylor mentioned the importance of gathering information needs of the model before constructing the questionnaires (1996). Yet there is little research on the relationship

between innovation models and questionnaires; the quality of questionnaires for innovation models is still a matter of curiosity.

3.2 Statement of Hypotheses

In this research, the researcher focused on two components of questionnaires of innovation models. These are innovation model perspective and question perspective. She believes that these factors equally determine the quality of questionnaires of innovation models.

From the innovation model perspective,

Research Question 1: "Do the questionnaires for applications of innovation models sufficiently address the parameters of these respective models?"

Hypothesis 1: The questionnaires of applications of innovation models do not include all the core constructs of the original model.

From the question perspective,

Research Question 2a: "Are the questions structured so as to get impartial responses from participants?"

Research Question 2b: "If they are not, what factors might affect the responses of the participants?"

Hypothesis 2: The questions of questionnaires have a structure that affects the responses of the participants.

Research Question 3: Do questionnaires for innovation acceptance models have high quality?

Hypothesis 3: The questionnaires of innovation models have low quality.

3.3 Description of Research Design

The research followed a logical step-by-step process. The first step was determining the models that were going to be examined. Five different models were chosen including Theory of Reasoned Action (Ajzen and Fishbein, 1980), Theory of Planned Behavior (Ajzen, 1991), Technology Acceptance Model (Davis, 1989), Innovation Diffusion Model (Rogers, 1995), and Unified Theory of Acceptance and Use of Technology (Venkatesh, Morris, Davis & Davis, 2003). The second step was individually reviewing the core constructs of each of these models.

The core constructs are:

Theory of Reasoned Action (TRA),

Attitude toward Behavior (A) and Subjective Norm (SN)

Theory of Planned Behavior (TPB),

Attitude toward Behavior (A), Subjective Norm (SN) and Perceived Behavioral Control (PBC)

Technology Acceptance Model (TAM),

Perceived Usefulness (U) and Perceived Ease of Use (E)

Innovation Diffusion Theory (DoI),

Relative Advantage (R), Compatibility (CB), Complexity (CX), Triability (T), and Observability (O)

Unified Theory of Acceptance and Use of Technology (UTAUT),

Performance Expectancy (PE), Effort Expectancy (EE), Social Influence (SI), and Facilitating Conditions (FC)

To evaluate the first hypothesis, applications of each model's core constructs were examined separately. Core constructs were supposed to be fully covered in the questionnaires.

Addressing all core constructs of models (X1) is determined by the sum of the means of the constructs of the respective models.

X1= 0.20*Mean (TRA)+0.20*Mean (TPB)+0.20*Mean (TAM)+0.20*Mean (DOI)+0.20*Mean (UTAUT)

Mean TRA= (Mean (A) + Mean (SN))/2

Mean TPB= (Mean (A) + Mean (SN) + Mean (PBC))/3

Mean TAM= (Mean (U) + Mean (E))/2

Mean DOI= (Mean (R) + Mean (CB) + Mean (CX) + Mean (T) + Mean (O))/5

Mean UTAUT= (Mean (PE) + Mean (EE) + Mean (SI) + Mean (FC))/4

The next step focused on the second perspective of this research, that is, construction of the questionnaires. As mentioned above, to get impartial data, questions must be isolated from influential effects. The researcher believes that impartial questionnaires must not include influential quantifiers, ambiguity, numeric rating scale and nonobjective questions.

Impartial questionnaires (X2)= (Mean of (influential quantifiers) + Mean of (ambiguous questions) + Mean of (nonobjective questions))/3.

Influential quantifiers are linguistic forms that express a contrast in quantity such as some, many, little, all in question wording that influences participants.

For instance, after asking the same question to the same people with different quantifiers, Harris got different results. When he asked, “How long was the movie?” the result was 130 minutes. On the other hand, when he asked, “How short was the movie?” the result was 100 minutes.

Ambiguous questions contain unfamiliar words and/or words that have multiple meanings (Peterson, 2010).

Peterson’s (2000) experiment is a great example for the issue. Participants were asked, “How often do they attend movies?” And multiple-choice answers were given: very infrequently, infrequently, frequently and very frequently. Participants not only were asked for the answer, but also were asked to indicate what that choice means them in numerical terms. After answering questions, participants were asked to indicate the meaning of each alternative in numerical terms. The results showed that adjectives or adverbs could have different meanings for different people.

Movie Alternative	Modal Response*	Range*
Very Infrequently	2	0-12
Infrequently	12	2-52
Frequently	26	4-104
Very frequently	52	52-365

*Measured in movies per year.

Table 5. Ambiguity in Answer Alternatives (Peterson, 2000)

People who go to movies 0-12 times in a year chose "very infrequently" whereas people who go to movies 2-52 times in a year chose "infrequently".

Also people who go to movies 4-104 times in a year chose "frequently" whereas people who go to movies 52-365 times in a year chose "very frequently".

According to Table 5, if a person goes to movies four times a year, he can choose any of "very infrequently", "infrequently", "frequently" choices because all of these choices contain 4 as an answer.

Nonobjective choices are given to hear the expected answer. These choices presuppose a common state of mind.

For example, the question is “How well do you like this new software?” and the multiple-choice answers are

- Extremely well
- Very well
- Pretty well
- Not too well

In these choices only the positive side is represented; also the answer alternatives are not balanced (Peterson, 2000). Three of the four alternatives are positive, whereas only one alternative is negative.

According to the researcher the quality of questionnaires for innovation models is determined by a weight that distributes equally the findings from the two hypotheses.

Quality of Questionnaires (X3)= X1*0.5 + X2*0.5

In other words, the questionnaire should include all the core constructs of the innovation model and have impartial questions to be considered high quality.

The hypothesis states that questionnaires of innovation models have low quality. A very important thing here is defining “low”. Since these questionnaires are tools for measuring the acceptance of innovations, 85% quality is the threshold-desired quality. This study posits a quality below 85% percent as low quality.

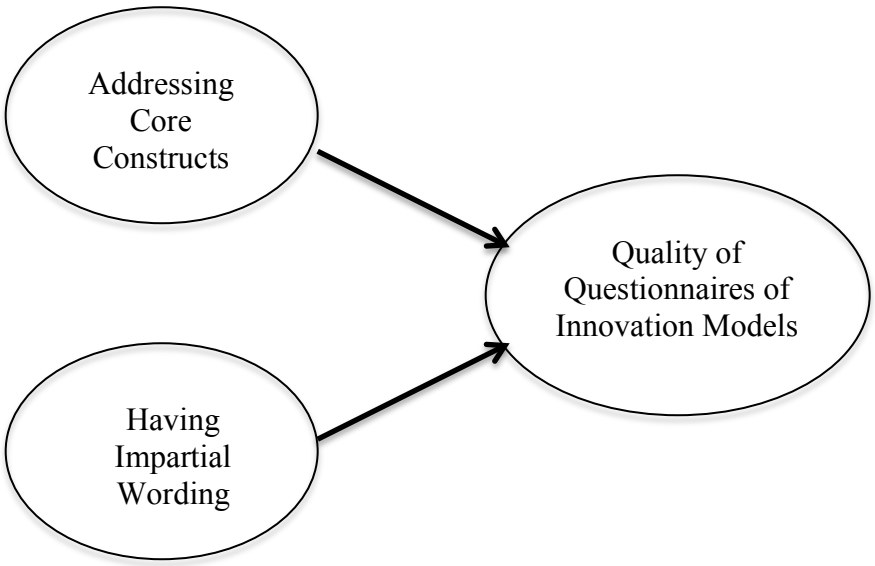

Figure 6 Research Model

3.4 Selection of Data

Information was gathered from published dissertations based on original versions of innovation acceptance models. A total of 31 articles pertaining to innovation models and their questionnaires was the sample for this research. To find dissertations on the concept, the ProQuest database was chosen. The reason to choose ProQuest was that it offers a wide variety of research sources. Also, the ProQuest database has

dissertation publishing services. According to the official website of Proquest, more than 700 universities work with ProQuest, and these universities publish more than 60,000 graduate studies every year (http://www.proquest.com/en-US/products/dissertations/).

While selecting data, this framework was followed:

First, each innovation acceptance model's dissertation base was searched separately.

Key words for search were: Model Name, innovation, technology, application, acceptance, and adoption. Various versions of these words were tried. A total number of 25 dissertations were selected for each model.

Second, eliminations were done according to study limitations.

Criteria for dissertations were:

- All dissertations must include questionnaires.
- Dissertations must be applications of one individual model.
- Dissertations with more than one model or mixed models must be eliminated.
- Questionnaires of innovation acceptance models must include closed-ended questions.
- Questionnaires with open-ended questions or mixed questions (open-ended and closed-ended) must be eliminated.

After having one single model and closed-ended questionnaires, dissertations are ready to be examined.

Two different tables have been provided for the two different perspectives of research.

For the first table, each model's core constructs were separately investigated.

For instance, Theory of Reasoned Action has two core constructs: Attitude toward Behavior and Subjective Norms. These two core constructs are expected to be in the dissertation on TRA. As an illustration, Dissertation 1 includes Attitude toward Behavior and Subjective Norm. X is given both of these core constructs. On the other hand, in Dissertation 2, Subjective Norm is not included. Thus, - is given to Subjective Norm whereas X is given to Attitude toward Behavior, which is included in the dissertation. If constructs are in the model 1 point is given to each construct; if they are not included 0 point is given to constructs. Since both constructs of the model are addressed in this dissertation, 1 point is given to both of them.

Theory of Reasoned Action	Attitude toward Behavior (A)	Subjective Norm (SN)	Points of Dissertations
Dissertation 1	X (1point)	X (1 point)	Mean of (A+SN)
Dissertation 2	X (1 point)	- (0 point)	Mean of (A+SN)
Overall Point	Mean of A	Mean of SN	Mean of Points of Dissertations

Table 6. Illustration of how evaluation of core constructs are examined

In the second table (Table 7) every single question is examined to see if they have influential quantifiers, ambiguity, and nonobjective choices. This table is similar to Table 6, but the only difference is instead of core constructs, wording effects, influential quantifiers, ambiguous questions, and nonobjective choices have been examined. As an illustration,

Theory of Reasoned Action	Influential Quantifiers (IQ)	Ambiguous Questions (AQ)	Nonobjective Choices (NoC)	Points of Dissertations
Dissertation 1	X (0 point)	- (1 point)	X (0 point)	Mean of (IQ +AQ +NoC)
Dissertation 2	- (1 point)	X (0 point)	X (0 point)	Mean of (IQ +AQ +NoC)
Overall Point	Mean of IQ	Mean of AQ	Mean of NoC	Mean of Points of Dissertations

Table 7. Illustration of evaluation of wording effect in questionnaires

As is seen from Table 7, Dissertation 1 has influential quantifiers and nonobjective questions whereas ambiguous questions were not included. Thus X is given to influential quantifiers and nonobjective choices and – is given to ambiguous questions. On the other hand, Dissertation 2 does not include influential quantifiers, while including ambiguous questions and nonobjective choices. X is given to

ambiguous questions and nonobjective choices whereas – is given to influential quantifiers.

In this case, there are three different factors that affect the participants' responses. Each of the factors' weight is distributed equally. If one factor is included in the questionnaire, 0 point is given to that factor. On the other hand, if the factor is not included in the questionnaire, 1 point is given to that factor.

Moreover, two different kinds of tables are integrated to calculate the quality of questionnaires. Both perspectives have the same weight on quality of questionnaires.

To sum up, this framework is used to collect dissertations, eliminate dissertations according to research criteria and examine dissertations based on the research model.

Chapter 4. RESEARCH RESULTS

Dissertations were individually examined based on the research model. Hypotheses are discussed sequentially as explained in Table 6 and Table 7.

Hypothesis 1: The questionnaires for innovation models do not include all the core constructs of the original model.

X1= 0.20*Mean (TRA)+0.20*Mean (TPB)+0.20*Mean (TAM)+0.20*Mean (DoI)+0.20*Mean (UTAUT)

In this part of the study, core constructs from each respective model are individually searched if questionnaires include them.

Theory of Reasoned Action (TRA):

Mean TRA= (Mean (A) + Mean (SN))/2

Dissertation	Attitude Toward Behavior		Subjective Norm		Dissertation Point
$D_{TRA}1$	X	1	X	1	1.00
$D_{TRA}2$	X	1	X	1	1.00
$D_{TRA}3$	X	1	X	1	1.00
$D_{TRA}4$	X	1	X	1	1.00
$D_{TRA}5$	X	1	X	1	1.00
$D_{TRA}6$	X	1	X	1	1.00
	1.00		1.00		1.00

Table 8. Dissertations of TRA Core Construct Analysis

In TRA analysis, 6 different dissertations were examined based on questionnaire criteria. Table 8 shows that questionnaires of Theory of Reasoned Action address all core constructs of TRA in their questionnaires.

Theory of Planned Behavior (TPB):

TPB has three core constructs: Attitude (A), Subjective Norm (SN) and Perceived Behavioral Control (PBC)

Mean TPB= (Mean (A) + Mean (SN) + Mean (PBC))/3

Dissertation Name	Attitude		Subjective Norm		Perceived Behavioral Control		Dissertation Point
$D_{TPB}1$	X	1	X	1	X	1	1.00
$D_{TPB}2$	X	1	X	1	X	1	1.00
$D_{TPB}3$	X	1	X	1	X	1	1.00
$D_{TPB}4$	X	1	X	1	X	1	1.00
$D_{TPB}5$	X	1	X	1	X	1	1.00
$D_{TPB}6$	X	1	X	1	X	1	1.00
$D_{TPB}7$	X	1	X	1	X	1	1.00
	1.00		1.00		1.00		1.00

Table 9. Dissertations of TPB Core Construct Analysis

Beginning with the examination of TPB dissertations, 25 different dissertations were randomly selected. Based on research criteria 18 dissertations were eliminated, and only 7 dissertations were analyzed. Table 9 shows that all the dissertations addressed the core constructs of the model.

Technology Acceptance Model (TAM):

TAM has two core constructs in the model: Perceived Usefulness (U) and Perceived Ease of Use (E)

Mean TAM= (Mean (U) + Mean (E))/2

Dissertation Name	Perceived Usefulness		Perceived Ease of Use		Dissertation Point
$D_{TAM}1$	X	1	X	1	1.00
$D_{TAM}2$	X	1	X	1	1.00
$D_{TAM}3$	X	1	X	1	1.00
$D_{TAM}4$	X	1	X	1	1.00
$D_{TAM}5$	X	1	X	1	1.00
$D_{TAM}6$	X	1	X	1	1.00
$D_{TAM}7$	X	1	X	1	1.00
	1.00		1.00		1.00

Table 10. Dissertations of TAM Core Construct Analysis

Similar to TPB, analysis of TAM started with 25 dissertations but 18 of them were eliminated according to research criteria.

Questionnaires of 7 dissertations were examined, and this examination showed that all constructs were included in the questionnaires.

Diffusion of Innovation (DoI):

As is mentioned above, DoI has five different core constructs: Relative Advantage (R), Compatibility (CB), Complexity (CX), Triability (T), and Observability (O)

Since DoI has five different constructs, the sum of the core constructs' means will be divided by 5.

Mean DoI = (Mean (R) + Mean (CB) + Mean (CX) + Mean (T) + Mean (O))/5

Dissertation Name	Relative Advantage		Compatibility		Complexity		Triability		Observability		Dissertation Point
$D_{DoI}1$	X	1	X	1	X	1	X	1	X	1	1.00
$D_{DoI}2$	X	1	X	1	X	1	X	1	X	1	1.00
$D_{DoI}3$	X	1	X	1	X	1	X	1	X	1	1.00
$D_{DoI}4$	X	1	X	1	X	1	X	1	X	1	1.00
	1.00		1.00		1.00		1.00		1.00		1.00

Table 11. Dissertations of DoI Core Construct Analysis

Randomly selected 25 dissertations of DoI were the least suitable ones based on the research criteria. Only 4 of them addressed the requirements of the model. Eliminated ones were either included mixed models or open-ended questions. Yet the ones that are compatible with the research criteria addressed all constructs of DoI in the questionnaires for dissertations.

Unified Theory of Acceptance and Use of Technology (UTAUT):

UTAUT has four different constructs as mentioned above: Performance Expectancy (PE), Effort Expectancy (EE), Social Influence (SI), and Facilitating Conditions (FC)

Because of UTAUT having four different constructs, the mean is calculated by dividing the sum of the means of all core constructs by four.

Mean UTAUT= (Mean (PE) + Mean (EE) + Mean (SI) + Mean (FC))/4

Dissertation Name	Performance Expectancy		Effort Expectancy		Social Influence		Facilitating Conditions		Dissertation Point
$D_{UTAUT}1$	X	1	X	1	X	1	X	1	1.00
$D_{UTAUT}2$	X	1	X	1	X	1	X	1	1.00
$D_{UTAUT}3$	X	1	X	1	X	1	-	0	0.75
$D_{UTAUT}4$	X	1	X	1	X	1	X	1	1.00
$D_{UTAUT}5$	X	1	X	1	X	1	X	1	1.00
$D_{UTAUT}6$	X	1	X	1	X	1	-	0	0.75
$D_{UTAUT}7$	X	1	X	1	X	1	X	1	1.00
	1.00		1.00		1.00		0.71		0.93

Table 12. Dissertations of UTAUT Core Construct Analysis

Seven dissertations out of twenty-five dissertations maintained research criteria and were analyzed according to the research model. Analysis showed that all dissertations of UTAUT Model do not include the core constructs of the model in the questionnaire of the dissertations. UTAUT is the only model that does not include all core constructs in these models. Only 71% of these dissertations addressed the facilitating conditions factor in their questionnaires; thus when the overall mean of means of all core constructs was calculated, the result is 93%. It means that 93% of dissertations address all core constructs of UTAUT.

After analyzing five models based on if they address all core constructs of the models, hypothesis 1 could be examined.

X1= 0.20*Mean (TRA)+0.20*Mean (TPB)+0.20*Mean (TAM)+0.20*Mean (DOI)+0.20*Mean (UTAUT)

X1= 0.20*1+0.20*1+0.20*1+0.20*1+0.20*0.93

X1=0.99

This calculation showed that 99% of dissertations address all core constructs.

Hypothesis 1 suggested that questionnaires of innovation models do not address core constructs of model yet the results showed that 99% of questionnaires of dissertations do address the core constructs.

Hypothesis 2

The questions of questionnaires have a structure that affects the responses of the participants.

In this stage of research if questions of questionnaires include influential quantifiers, ambiguous questions and nonobjective questions was examined.

Impartial questionnaires (X2)= (Mean of (influential quantifiers) + Mean of (ambiguous questions) + Mean of (nonobjective questions))/3.

Basically, the mean of the sum of means of Wording Effect factors was calculated based on key words from the literature review. If a dissertation has a Wording Effect factor, 0 is given to that factor; if it does not have a wording effective factor, 1 is given to that factor.

Table 13, Table 14, Table 15, Table 16 and Table 17 show analyses of questionnaires of dissertations.

Dissertation Name	Influential Quantifiers		Ambiguous Questions		Nonobjective Choices		Dissertation Point
$D_{TRA}1$	X	0	X	0	X	0	0
$D_{TRA}2$	X	0	X	0	X	0	0
$D_{TRA}3$	X	0	X	0	-	1	0.33
$D_{TRA}4$	-	1	X	0	-	1	0.67
$D_{TRA}5$	-	1	-	1	-	1	1
$D_{TRA}6$	-	1	-	1	X	0	0.67
	0.5		0.33		0.5		0.44

Table 13. Dissertations of TRA Wording Effect Factor Analysis

In dissertations of TRA, three out of six questionnaires include influential quantifiers and nonobjective choices, whereas four out of six questionnaires include ambiguous questions.

$X2_{TRA}$=(0.5+0.33+0.5)/3=0.44

Overall 44% of dissertations have impartial questionnaires.

Table 14 shows the calculation for TPB, three out of seven dissertations include influential quantifiers and ambiguous questions, whereas only one of them includes nonobjective choices.

$X2_{TPB}$ = (0.57+0.57+0.86)/3=0.67

Overall 67% of dissertations have impartial questionnaires.

This result shows that dissertations on TPB include more impartial questionnaires than TRA.

Dissertation Name	Influential Quantifiers		Ambiguous Questions		Nonobjective Choices		Dissertation Point
$D_{TPB}1$	X	0	X	0	-	1	0.33
$D_{TPB}2$	-	1	-	1	-	1	1.00
$D_{TPB}3$	-	1	-	1	-	1	1.00
$D_{TPB}4$	X	0	X	0	X	0	0.00
$D_{TPB}5$	-	1	X	0	-	1	0.67
$D_{TPB}6$	-	1	-	1	-	1	1.00
$D_{TPB}7$	X	0	-	1	-	1	0.67
	0.57		0.57		0.86		0.67

Table 14. Dissertations of TPB Wording Effect Factor Analysis

TAM calculations are shown in Table 15. One out of seven dissertations include influential quantifiers and nonobjective choices, whereas three of them include ambiguous questions.

$X2_{TAM} = (0.86+0.86+0.57)/3=0.76$

Overall 76% of dissertations include impartial questionnaires.

Dissertation Name	Influential Quantifiers		Ambiguous Questions		Nonobjective Choices		Dissertation Point
$D_{TAM}1$	-	1	X	0	X	0	0.33
$D_{TAM}2$	-	1	X	0	-	1	0.67
$D_{TAM}3$	-	1	X	0	-	1	0.67
$D_{TAM}4$	X	0	-	1	-	1	0.67
$D_{TAM}5$	-	1	-	1	-	1	1.00
$D_{TAM}6$	-	1	-	1	-	1	1.00
$D_{TAM}7$	-	1	-	1	-	1	1.00
	0.86		0.57		0.86		0.76

Table 15. Dissertations of TAM Wording Effect Factor Analysis

Table 16 shows calculations for DoI. Despite the fact that any of questionnaires of dissertations do not include influential quantifiers, three out of four dissertation questionnaires include ambiguous questions and one of them includes nonobjective choices.

$X2_{DoI} = (1+0.25+0.75)/3=0.67$

Overall 67% of dissertations include impartial questionnaires.

Dissertation Name	Influential Quantifiers		Ambiguous Questions		Nonobjective Choices		Dissertation Point
$D_{DoI}1$	-	1	X	0	-	1	0.67
$D_{DoI}2$	-	1	X	0	X	0	0.33
$D_{DoI}3$	-	1	X	0	-	1	0.67
$D_{DoI}4$	-	1	-	1	-	1	1.00
	1.00		0.25		0.75		0.67

Table 16. Dissertations of DoI Wording Effect Factor Analysis

The last table for examining hypothesis 2 is Table 17. This table shows calculations for UTAUT. The analysis showed that three of seven dissertations

include influential quantifiers and ambiguous questions, whereas only one dissertation includes nonobjective choices.

$X2_{UTAUT} = (0.57+0.57+0.86)/3=0.67$

Overall 67% of UTAUT dissertations include impartial questionnaires.

Dissertation Name	Influential Quantifiers		Ambiguous Questions		Nonobjective Choices		Dissertation Point
$D_{UTAUT}1$	-	1	X	0	-	1	0.67
$D_{UTAUT}2$	X	0	X	0	-	1	0.33
$D_{UTAUT}3$	-	1	-	1	-	1	1.00
$D_{UTAUT}4$	X	0	-	1	-	1	0.67
$D_{UTAUT}5$	-	1	X	0	-	1	0.67
$D_{UTAUT}6$	-	1	-	1	X	0	0.67
$D_{UTAUT}7$	X	0	-	1	-	1	0.67
	0.57		0.57		0.86		0.67

Table 17. Dissertations of UTAUT Wording Effect Factor Analysis

Hypothesis 2 suggests that questions on questionnaires have a structure that affects the responses of the participants.

The overall mean is the average of the sum of each factor's mean of Wording Effect analysis. This equation is,

Impartial questionnaires (X2)= (Mean of (influential quantifiers) + Mean of (ambiguous questions) + Mean of (nonobjective questions))/3.

As is seen from Table 18 the mean of influential quantifiers is 0.70; the mean of ambiguous questions is 0.46 and the mean of nonobjective choices 0.76.

Overall Mean=X2= (0.70+0.46+0.76)/3

X2= 0.64

So 64 percent of dissertations have impartial questionnaires. In other words, 36 percent of dissertations include the Wording Effect factor in their questionnaires.

Models	Influential Quantifiers	Ambiguous Questions	Nonobjective Choices	Overall
TRA	0.5	0.33	0.5	0.44
TPB	0.57	0.57	0.86	0.67
TAM	0.86	0.57	0.86	0.76
DoI	1.00	0.25	0.75	0.67
UTAUT	0.57	0.57	0.86	0.67
Means	0.70	0.46	0.76	0.64

Table 18. Overall Wording Effect Factors Analysis

Hypothesis 3:

In the research model, it shows that the quality of questionnaires for innovation models is affected by addressing core constructs of models as well as having impartial wording in questionnaires. Addressing core constructs of models was examined in Table 8 to Table 12. The conclusion from that analysis was 99% of dissertations address the core constructs in the questionnaires. Moreover, having

impartial wording in questionnaires was examined in Table 13 to Table 18. The result from that analysis was 64% of questionnaires have impartial wording in questions.

After multiplying, each of these two findings by 0.5, since they have the same weight in the model, and adding them up, the result for hypothesis 3 can be calculated.

Quality of questionnaires for innovation acceptance models= Addressing Core Constructs*0.5 + Having Impartial Wording * 0.5

X3=X2*0.5 + X3*0.5

X3=0.99*0.5 +0.64*0.5

X3=0.81

This analysis shows that dissertations of innovation models have 81% quality.

Table 19 summarizes Hypothesis 3 based on calculations for Hypothesis 1 and Hypothesis 2.

MODEL	Hypothesis 1	Hypothesis 2				Model Point
		Influential Quantifiers	Ambiguous Questions	Nonobjective Choices	Total Points	
Theory of Reasoned Action	1	0.5	0.33	0.5	0.44	0.72
Theory of Planned Behavior	1	0.57	0.57	0.86	0.67	0.84
Technology Acceptance Model	1	0.86	0.57	0.86	0.76	0.88
Diffusion of Innovation	1	1.00	0.25	0.75	0.67	0.84
Unified Theory of Acceptance and Use of Technology	0.93	0.57	0.57	0.86	0.67	0.80
	0.99	0.70	0.46	0.76	0.64	0.81

Table 19. Research Model Calculation

Chapter 5. DISCUSSION

As Peterson claimed, asking questions is one of the most omnipresent ways of communication (2000). Before researchers introduce their innovations to public, they conduct surveys with questionnaires to predict acceptance tendency of customers. It is seen that the data gathered from these questionnaires is not valid and reliable enough to count on. The researcher suspected that researchers do not ask the right questions to participants. In order to examine the questionnaires, it was necessary to go through all the questions of the questionnaires. Published journal articles do not include questionnaires in the text; on the other hand, dissertations include questionnaires as an appendix. Thus, she decided to examine dissertations of innovation acceptance models. This research questioned that what kinds of factors affect the quality of questionnaires of innovation acceptance models. The researcher suspected that these questionnaires do not address the core constructs of innovation models and do not have an impartial wording. The quality of questionnaires is determined by these factors.

First of all, findings showed that the first hypothesis, which suggests that researchers of models do not address core constructs of innovation acceptance models in their questionnaire, failed. Fully 99% of the dissertations reviewed included core construct related questions in the questionnaires that directly addressed all the core constructs in the related models. Only 2 dissertations of UTAUT do not include one core construct of the model. Surprisingly, dissertations of TRA, TPB, TAM and DoI included core constructs in their questionnaires. The main reason for getting 100%

from TPB Model might be Ajzen's proposed model of how to address core constructs in the questionnaire for TPB. Since TPB is derived from TRA, and also TAM was derived from TRA, these models' questionnaires have a guideline for their construction. So it is not surprising that for all these related models, the questionnaires address the core constructs.

Secondly, it was expected that questionnaires have wording that might/can affect responses of participants. As is seen from Table 18, only 64% of questionnaires have impartial wording in questionnaires. Thirty six percent of dissertations have wording that might/can affect bias the responses. This number is not a low number to disregard, and it supports hypothesis 2. It means that 36% of the questionnaires examined could collect data for their models that is meaningless from of all questionnaires for all models.

Especially, the biggest portion of wording effect factors is ambiguous questions with 54%. Seventy five percent of DoI questionnaires have ambiguous questions; TRA follows DoI with 67%. The other three models have the same percentage of ambiguous question, which is 43%.

Nonobjective choice as a wording effect factor is the least seen factor in questionnaires, at 24%. Confusing (e.g., 0 to 10, -5 to 5) Rating Scales have been used in most of these questionnaires of dissertations.

Finally, hypothesis 3 stated that overall questionnaires for innovation acceptance models have low quality. Table 19 showed that overall quality of questionnaires is 81%. This quality will be low or high depending on your reference point. If your reference point is 85%, the calculated quality is low; on the other hand, if your

reference point is 65%, the calculated quality is high. In this research, below 85% is posited as low quality. Thus, the results supported that questionnaires of innovation models have low quality.

There are not a good number of studies on this subject. A combination of innovation models and questionnaires should be studied in the future. In this research, only questions were examined. To understand this combination more extensively, questions and answers might be examined together.

In conclusion, given the low fraction of questionnaires examined that are free from one or more of the errors in fashioning objective, high quality questions to provide data for examining innovation acceptance models is it surprising; that the models have not been successful in predicting customer behaviors. It is true, then, that the questionnaires for innovation acceptance models should, indeed, be questioned, for therein may lie the roots of poor performance of the models.

REFERENCES

Adams, D. A., Nelson, R., & Todd, P. A. (1992). Perceived Usefulness, Ease of Use, and Usage of Information Technology: A Replication. *MIS Quarterly*, *16*(2), 227-247.

Ajzen, I. (2006) *Constructing a TPB questionnaire: Conceptual and methodological considerations*. Retrieved January 15, 2012 from http://people.umass.edu/aizen/tpb.html

Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes, 50*(2), 179-179. Retrieved from http://search.proquest.com/docview/223187166?accountid=11243

Ajzen, I., & Fishbein, M. (1980). *Understanding attitudes and predicting social behavior/ Icek Ajzen, Martin Fishbein*. Englewood Cliffs, N.J.: Prentice-Hall, c1980.

Babbie, E. R. (2010). *The practice of social research / Earl Babbie*. Belmont, Calif : Wadsworth Cengage, c2010.

Bagozzi, R. P., Baumgartner, H., & Yi, Y. (1992). Appraisal processes in the enactment of intentions to use coupons. *Psychology & Marketing (1986-1998), 9*(6), 469-469. Retrieved from http://search.proquest.com/docview/230393192?accountid=11243

Baron, S., Patterson, A., & Harris, K. (2006). Beyond technology acceptance: Understanding consumer practice. *International Journal of Service Industry Management, 17*(2), 111-135. Retrieved from http://search.proquest.com/docview/233664484?accountid=11243

Brace, I. (2008). *Questionnaire design : how to plan, structure and write survey material for effective market research / Ian Brace*. London ; Philadelphia : Kogan Page, 2008.

Chiesa, V., & Frattini, F. (2011). Commercializing Technological Innovation: Learning from Failures in High-Tech Markets. *Journal Of Product Innovation Management*, *28*(4), 437-454. doi:10.1111/j.1540-5885.2011.00818.x

Curtis, L., Edwards, C., Fraser, K. L., Gudelsky, S., Holmquist, J., Thornton, K., & Sweetser, K. D. (2010). Adoption of social media for public relations by nonprofit organizations. *Public Relations Review, 36*(1), 90. Retrieved from http://search.proquest.com/docview/224987894?accountid=11243

Davis, Fred Donald, Jr. (1986). *A technology acceptance model for testing new end-user information systems: Theory and results.* Massachusetts Institute of Technology. *ProQuest Dissertations and Theses,* , 1. Retrieved from http://search.proquest.com/docview/303543930?accountid=11243

Davis, F. D. (1989). Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology. *MIS Quarterly*, *13*(3), 319-340.

Davis, F. D., Bagozzi, R. P., & Warshaw, P. R. (1989). User acceptance of computer technology: A comparison of two theoretical models. *Management Science, 35*(8), 982-982. Retrieved from http://search.proquest.com/docview/213229133?accountid=11243

Davis, F. D., Bagozzi, R. P., & Warshaw, P. R. (1992). Extrinsic and intrinsic motivation to use computers in the workplace. *Journal Of Applied Social Psychology*, *22*(14), 1111-1132. doi:10.1111/j.1559-1816.1992.tb00945.x

Dyer, J., Gregersen, H. B., & Christensen, C. M. (2011). *The innovator's DNA : mastering the five skills of disruptive innovators / Jeff Dyer, Hal Gregersen, Clayton M. Christensen*. Boston, Mass. : Harvard Business Press, c2011.

Fishbein, M., & Ajzen, I. (1975). *Belief, Attitude, Intention, and Behavior: An Introduction to Theory and Research.* Reading, MA: Addison-Wesley.

Garfield, M. J. (2005). Acceptance of ubiquitous computing. *Information Systems Management, 22*(4), 24-31. Retrieved from http://search.proquest.com/docview/214124125?accountid=11243

Godin, G., & Kok, G. (1996). The theory of planned behavior: A review of its applications in health-related behaviors. *American Journal of Health Promotion*

Harris, R. J. (1973). Answering questions containing marked and unmarked adjectives and adverbs. *Journal Of Experimental Psychology*, *97*(3), 399-401. doi:10.1037/h0034165

Igbaria, M., Guimaraes, T., & Davis, G. B. (1995). Testing the Determinants of Microcomputer Usage via a Structural Equation Model. *Journal Of Management Information Systems*, *11*(4), 87-114.

Jackson, C. M., Chow, S., & Leitch, R. A. (1997). Toward an understanding of the behavioral intention to use an information system. *Decision Sciences, 28*(2), 357-389. Retrieved from http://search.proquest.com/docview/198097511?accountid=11243

Katz, E., Levin, M. L., & Hamilton, H. (1963). Traditions of research on the diffusion of innovation. *American Sociological Review, 28*(2), 237-252. Retrieved from http://search.proquest.com/docview/60553573?accountid=11243

Kinnear, T. C., & Taylor, J. R. (1996). *Marketing research: an applied approach / Thomas C. Kinnear, James R. Taylor*. New York: McGraw-Hill, c1996.

Koivumäki, T., Ristola, A., & Kesti, M. (2008). The perceptions towards mobile services: An empirical analysis of the role of use facilitators. *Personal and Ubiquitous Computing, 12*(1), 67-75. doi:10.1007/s00779-006-0128-x

Legris, P., Ingham, J., & Collerette, P. (2003). Why do people use information technology? A critical review of the technology acceptance model. *Information & Management, 40*(3), 191-204. Retrieved from http://search.proquest.com/docview/237020239?accountid=11243

Loftus, E. F. (1975). Leading questions and the eyewitness report. *Cognitive Psychology*, *7*(4), 560-572. doi:10.1016/0010-0285(75)90023-7

Loftus, E. F., & Palmer, J. C. (1974). Reconstruction of automobile destruction: an example of the interaction between language and memory. *Journal Of Verbal Learning & Verbal Behavior*, *13,* 585-589.

Madden, T. J., Ellen, P. S., & Ajzen, I. (1992). A comparison of the theory of planned behavior and the theory of reasoned action. *Personality and Social Psychology Bulletin, 18*(1), 3-3. Retrieved from http://search.proquest.com/docview/213999725?accountid=11243

Mahajan, V., Muller, E., & Bass, F. M. (1990). New Product Diffusion Models in Marketing: A Review and Directions for Research. *Journal Of Marketing*, *54*(1), 1-26.

Moore, G. C., & Benbasat, I. (1991). Development of an Instrument to Measure the Perceptions of Adopting an Information Technology Innovation. *Information Systems Research*, *2*(3), 192-222.

Payne, S. (1951). *The art of asking questions*. Princeton, Princeton University Press, 1951.

Peterson, R. A. (2000). *Constructing effective questionnaires / Robert A. Peterson*. Thousand Oaks : Sage Publications, c2000.

ProQuest. (2012). *ProQuest Dissertation Publishing.* Retrived from http://www.proquest.com/en-US/products/dissertations/

Rogers, E. M. (1995). *Diffusion of innovations / Everett M. Rogers*. New York : Free Press, c1995.

Rogers, E. M. (2003). *Diffusion of innovations / Everett M. Rogers*. New York: Free Press, 2003.

Ryan, M. J. (1982). Behavioral Intention Formation: The Interdependency of Attitudinal and Social Influence Variables. *Journal Of Consumer Research*, *9*(3), 263-278.

Quine, Lyn, D. R. Rutter, and Laurence Arnold. 2001. Persuading school-age cyclists to use safety helmets: Effectiveness of an intervention based on the theory of planned behavior. *British Journal of Health Psychology* 6, : 327-327, http://search.proquest.com/docview/215246093?accountid=11243 (accessed January 14, 2012).

Schwarz, N. (1999). Self-reports: How the questions shape the answers. *American Psychologist*, *54*(2), 93-105. doi:10.1037/0003-066X.54.2.93

Schwarz, N., Hippler, H. J., Deutsche, B., & Strack, F. (1985). Response Scales: Effects of Category Range on Reported Behavior and Comparative Judgments. *Public Opinion Quarterly*, *49*(3), 388-395.

Schwarz, N., Knäuper, B., Hippler, H. J., Noelle-Neumann, E., & Clark, L. (1991). Rating Scales. *Public Opinion Quarterly*, *55*(4), 570-582.

Schuman, H., & Scott, J. (1987). Problems in the use of survey questions to measure public opinion. *Science, 236*(4804), 957-957. Retrieved from http://search.proquest.com/docview/213532390?accountid=11243

Sheppard, B. H., Hartwick, J., & Warshaw, P. R. (1988). The Theory of Reasoned Action: A Meta-Analysis of Past Research with Recommendations for Modifications and Future Research. *Journal Of Consumer Research*, *15*(3), 325-343. Retrieved from http://search.proquest.com/docview/215050440?accountid=11243

Shimp, T. A., & Kavas, A. (1984). The Theory of Reasoned Action Applied to Coupon Usage. *Journal Of Consumer Research*, *11*(3), 795-809.

Taylor, S., & Todd, P. (1995). Assessing IT usage: The role of prior experience. *MIS Quarterly, 19*(4), 561-561. Retrieved from http://search.proquest.com/docview/218111927?accountid=11243

Thompson, R. L., Higgins, C. A., & Howell, J. M. (1991). Personal computing: Toward a conceptual model of utilization. *MIS Quarterly, 15*(1), 125-125. Retrieved from

http://search.proquest.com/docview/218128965?accountid=11243

Venkatesh, V. (1999). Creation of favorable user perceptions: Exploring the role of intrinsic motivation. *MIS Quarterly, 23,* 239-260

Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User Acceptance of Information Technology: Toward a Unified View. *MIS Quarterly*, *27*(3), 425-478.

Venkatesh, V. & Speier, C. (1999). Computer technology training in the work place: Four longitudinal field studies. *Management Science, 46,* 186-204.

Warshaw, P. R. (1980a). A New Model for Predicting Behavioral Intentions: An Alternative to Fishbein. *Journal Of Marketing Research (JMR)*, *17*(2), 153-172.

Warshaw, P. R. (1980b). Predicting purchase and other behaviors from general and contextually specific intentions. *JMR, Journal of Marketing Research (Pre-1986), 17*(000001), 26-26. Retrieved from http://search.proquest.com/docview/208732118?accountid=11243