AN INVESTIGATION OF PRESERVICE EARLY CHILDHOOD TEACHERS' LEVELS OF INDIVIDUAL INNOVATIVENESS AND PERCEIVED ATTRIBUTES OF INSTRUCTIONAL COMPUTER USE

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ABSTRACT

AN INVESTIGATION OF PRESERVICE EARLY CHILDHOOD TEACHERS' LEVELS OF INDIVIDUAL INNOVATIVENESS AND PERCEIVED ATTRIBUTES OF INSTRUCTIONAL COMPUTER USE

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Based on Rogers' (2003) Diffusion of Innovations theory, this study aims to investigate preservice early childhood teachers' innovativeness level and perceived attributes of computer use in early childhood education. Moreover, the differences between adopter categories regarding the perceived attributes of computer use and communication channel preferences were examined within the scope of this study. For these purposes, this study was designed as a quantitative research and data were gathered by three scales, namely Turkish version of Perceived Attributes of Computer Use (PACU), Individual Innovativeness Scale (IIS), and General Information scale (GIS). A total of 436 questionnaires were collected from the preservice early childhood teachers studying at the universities in Ankara, Turkey. The gathered data were analyzed by using both descriptive statistical techniques and inferential statistical techniques.

The findings of the study showed that preservice early childhood teachers perceived that instructional computer use (1) provides advantages, (2) is not complex, and (3) can be observed in early childhood settings. Moreover, it was found that more than half of the preservice early childhood teachers were considered low in innovativeness level. Furthermore, in terms of adopter categories, the preservice early childhood teachers were placed in early majority, early adopters, late majority, innovators, and laggard group, respectively. Moreover, the results indicated that the preservice early childhood teachers who were grouped in five adopter categories were significantly different from each other regarding the perceived attributes of computer use. Finally, the results showed that most of the preservice teachers preferred interpersonal communication channels rather than mass media channels.

Key words: Diffusion of Innovations, preservice early childhood teachers, instructional computer use, perceived attributes, adopter categories

ÖZ

OKUL ÖNCESİ ÖĞRETMEN ADAYLARININ BİREYSEL YENİLİKÇİLİK DÜZEYLERİ VE ÖĞRETİM AMAÇLI BİLGİSAYAR KULLANIMINA YÖNELİK ALGILANAN ÖZELLİKLERİN ARAŞTIRILMASI

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Rogers'ın (2003) "Diffusion of Innovations – Yeniliklerin Yayılması" teorisi temelinde, bu çalışma, okul öncesi öğretmen adaylarının yenilikçilik düzeylerini ve öğretim amaçlı bilgisayar kullanımına ilişkin algılarını incelemektedir. Ayrıca, çalışma kapsamında, okul öncesi öğretmen adaylarının bilgisayar teknolojisi hakkında yeni bilgileri öğrenmek için tercih ettikleri iletişim kanalları betimlenmektedir. Bu çalışma, nicel bir çalışma olarak tasarlanmış ve veriler anket aracılığı ile Ankara'daki üniversitelerde eğitim gören 436 okul öncesi öğretmen adaylarından toplanmıştır. Toplanan bu veriler nicel araştırma yöntemi kapsamında betimsel ve yorumsal tekniklerle analiz edilmiştir. Çalışmanın verileri analiz edildiğinde, okul öncesi öğretmen adayları okul öncesinde bilgisayar kullanmanın zor olmadığına, gözlenebilir olduğuna ve kendileri için yarar sağlayacağına inandıkları belirlenmiştir. Ayrıca, okul öncesi öğretmen adaylarının yarısından fazlasının düşük yenilikçilik düzeyine sahip olduğu ve sırasıyla erken çoğunluk, erken benimseyenler, geç çoğunluk, yenilikçiler ve benimsemeyenler kategorisinde yer aldıkları görülmüştür. Bunun yanında, bu beş benimseyici kategoride bulunan okul öncesi öğretmen adaylarının, bilgisayar kullanmanın algılanan özellikleri hakkında farklı görüşlere sahip olduğu bulunmuştur. Çalışmanın diğer bulgusuna göre, okul öncesi öğretmen adayları, çoğunlukla bilgisayar teknolojileri ile ilgili yeni beceriler öğrenmek için kişiler arası iletişim kanallarını tercih etmektedirler.

Anahtar Kelimeler: Yeniliklerin yayılması, okul öncesi öğretmen adayları, öğretimsel bilgisayar kullanımı, algılanan özellikler, benimseyici kategoriler

To my dear Dad,

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ABBREVIATIONS

ISS: Individual Innovativeness Scale

ISTE: International Society for Technology in Education

GIS: General Information scale

MANOVA: Multivariate Analysis of Variances

MoNE: Ministry of National Education

NAEYC: National Association for the Education of Young Children

OECD: Organization for Economic Cooperation and Development

OTA: Office of Technology Assessment

PACU: Perceived Attributes of Computer Use

STI: Science, Technology and Innovation

UNESCO: United Nations Educational, Scientific and Cultural Organization

CHAPTER 1

INTRODUCTION

1.1 Background of the Study

Today, technology has become as the central of life (Broady, Chan & Caputi, 2010; Shields & Behrman, 2000). In other words, technology has altered the life in terms of people's works, forms of communication between people, and the methods for organizing and storing of the information (Swedin & Ferro, 2005). According to Rogers (2003), technology is "a design for instrumental action that reduces the uncertainty in the cause-effect relationships involved in achieving a desired outcome" (p.13). As it is seen the definition, technology could be utilized as a tool to meet a need or to solve a problem. Indeed, Pacific Policy Research Center (2010) indicates that technology has a role in the shaping and reflecting of the society. On the other hand, the Organisation for Economic Co-operation and Development (OECD, 2006) emphasizes the role of technology for the needs of today's economy and society. These needs are related to the new millennium skills and competences such as selecting and obtaining the information, then, analyzing, integrating and sharing the knowledge (OECD, 2006). Moreover, OECD (2006) continues that in order for new generation people to gain these skills and competences, schools are considered as the unique places. In addition, Bybee and Starkweather (2006) underlined the importance of technology in schools by saying "the emergence of economic issues and the essential role of technology in the global economy have highlighted the omission of technology in K-12 schools" (p. 27).

From this point of view, researchers (e.g. Clements, 1993; 1994; 1999; 2002; Haugland, 1992; 1999; 2000; Papert, 1993; Prensky, 2001) and educational organizations such as International Society for Technology in Education (ISTE), National Association for the Education of Young Children (NAEYC), United

Nations Educational, Scientific and Cultural Organization (UNESCO), and National Council for Accreditation of Teacher Education (NCATE) have undertaken for the effective use of technology in education. For example, Seymour Papert, is developer of new ideas for computers and education. After gaining new perspectives as working with Jean Piaget, he has studied on children's thinking and learning. Moreover, he is known as the creator of computer programme "LOGO" and the author of many books including "Mindstorms: Children, Computers and Powerful Ideas" (1980), "The Children's Machine: Rethinking School in the Age of the Computer" (1993), and "The Connected Family" (1996) (Boyle, 2004). Similarly, Douglas H. Clements has studied in the areas of mathematics education, educational technology, and early childhood education. He has conducted over 125 refereed research studies, published 18 books, 70 chapters, and 275 additional publications about computer use in early childhood education. Moreover, he has carried out some funded projects related to mathematics, science, and literacy in early childhood education (University at Buffalo, 2013). On the other hand, National Association for the Education of Young Children (NAEYC), the world's largest organization, aims to improve quality of early childhood education in terms of both early childhood professions and early childhood programs. Moreover, NAEYC states positions related technology use and supports to developmentally appropriate practices of technology use in early childhood education (NAEYC, 2013). Similarly, International Society for Technology in Education (ISTE), the initial association for educators and education leaders, launches initiatives for the effective technology use in K–12 and teacher education (ISTE, 2012). What is more, the studies indicated that technology has become a great power by providing rich environments for learning and teaching in education (Bergen, 2003; Haugland, 2000; Marina, 2001; Stoik, 2001). Therefore, technology could be utilized in different ways in classrooms (Dede, 2000). For example, students can have opportunity to make a conversation with a virtually invited guest speaker who is not able to visit the school or the classroom (Burg & Cleland, 2001) or the students having different type of intelligence can be reached, assessed, and educated (Prensky, 2008) or the students' academic achievement, motivation, higher order thinking skills, and problem solving abilities can be improved (Allegra, Chifori, Ottaviano, 2001; Boshuizen and Wopereis, 2003; Muir-Herzig, 2004; Lim & Chai, 2004; Naidu, Cunnington & Jasen, 2002; Ping, Swe, Hew, Wong, Shanti and Lim, 2003; Roblyer, 2006).

This is same for young children too. In the 1980s, there was a big debate about the role of technology in early childhood curriculum (Barnes & Hill, 1983; Cuffaro, 1984). However, researcher points to the significant contribution of computer use in the classroom as a learning tool in terms of enhancing cognitive, social, emotional, linguistic, and literacy skills in preschool children by considering their ages (Clements 1994, Clements & Nastasi, 1993; Clements & Sarama, 1998, 2002; Haugland 1992; Haugland & Wright, 1997; McCarrick & Li, 2007; McKenney & Voogt, 2009; NAEYC, 1996; Shade 1994; Plowman & Stephen, 2003; Vernadakis, Avgerinos, Tsitskari, & Zachopoulou, 2005). Moreover, Resnick (2000) suggested that compared with “traditional materials” computers can expand the range of things that children can create and in doing so enable them to encounter ideas that were not previously accessible to them. Therefore, after these advancements in research, it could be interpreted that research has already shifted beyond the common question of whether computers could help young children’s learning (Clements, 1999) and has recognized potential of technology in K-12 schools.

Because of this rapid change in technology and opportunities in educational settings, different countries have accordingly developed and applied their own science, technology and innovation (STI) policies (OECD, 2012). For example, according to United States’ Innovation Strategy, one of the main goals is to “educate the next generation with 21st century skills and create a world-class workforce” (p. 15). For this purpose, the U.S. plans to upgrade their educational system from early education to graduate school and to improve student achievement. Moreover, with the Advanced Research Projects Agency – Education (ARPA-ED), the United States aims to encourage research on development of new education technologies and digital learning materials to enhance learning (White House, 2011). Similarly, in Spain, the Act on Science, Technology and Innovation (STI Act) aims to integrate technology and innovation activities with scientific research. Furthermore, Spain has launched the “Plan Avanza2” to encourage ICTs in most areas such education, public administration, health care (OECD, 2012). In parallel with the developments in other countries, Turkey also has launched the project Increasing Opportunities and Improvement of Technology Movement (FATIH) to ensure equality of opportunity in education and training, to improve technology integration r early childhood education to high schools, and to provide interactive white boards, the Internet and tablet PCs to public schools (MoNE, 2012).

With these planned developments in the education system, however, it should be noted that the success of any change depends on adoption of this change by teachers (Fullan, 1991). The crucial role of the teachers was also stated by Zhao and Tella (2002), who discussed the effect of the teachers, as “They [teachers] are the “gate-keepers” of technology, who not only determine whether it enters the classroom, but also affects how it is used in the classroom. If it is not allowed in the classroom or not used properly, it cannot have the opportunity to exercise its educational power” (p. 1). In other words, teachers play a key role in effective technology use in a classroom or school teaching environment (Means & Olson, 1997) and purchasing and installing hardware and software does not mean successful technology integration in learning environments (Lippman, 1997). Indeed, without knowing teachers’ and future teachers’ views regarding to use of computer technology in education, a change in their computer use will result in disappointment (Office of Technology Assessment, 1995). Therefore, in order to examine reasons of and possible solutions to successful technology use, many theories and many models have been developed. For example, in order to understand people’s behavior changes, Fishbein and Ajzen (1975) proposed Theory of Reasoned Action (TRA). The theory aims to undersand individuals’ intended behaviors and the psychological factors behind their behaviors. For this purpose, two determinants are used to understand reasons of individual’s behavior. These are “attitude toward behavior” which is related to personal in nature and “subjective norm” which is related to social influence (Ajzen, 1985). However, since TRA was interested in understanding human behavior rather that predicting it, Theory of Planned Behavior (TPB) was presented by Ajzen (1991). As an extension of TRA, Theory of Planned Behavior also contained “perceived behavioral control” variable. These theories underlie some models related to individuals’ acceptance of technology. For example, based on TRA, Technology Acceptance Model (TAM) was developed by Davis (1986) for users’ information technology acceptance and use. This model aims to explain and predict individuals’ behaviors by two fundamental variables which are perceived usefulness and perceived ease of use (Lee, Kozar, & Larsen, 2003; Teo, 2009). However, in order to explain broader technology integration, it was stated that TAM needs to be extended (Legris, Ingham & Collerette, 2003). Therefore, TAM2 was developed by including the variable “subjective norm” which was adapted by TRA and TPB (Venkatesh, Morris, Davis & Davis, 2003). Moreover, unlike the TAM, Teo (2009) developed a model for technology use among preservice teachers. For this purpose, other variables were included in the model and it was found that perceived usefulness, computer self-efficacy, and attitude towards computer use had direct impact on individuals’ intention to use technology. Moreover, the model showed that perceived ease of use, technological complexity, and facilitating conditions had an indirect effect on individuals’ intention use technology (Teo, 2009). Similarly, Van Braak, Tondeur, and Valcke (2004) developed a path model to explore the effects of some variables such as demographics, computer related experiences, and attitudinal constructs on computer use among primary school teachers. This model proposes that the independent variables, computer experiences and general computer attitudes are the strongest predictors of supportive computer use while technological innovativeness and gender were main predictors of class computer use (Van Braak et al., 2004). On the other hand, Rogers’ (2003) Diffusion of Innovation theory is one of the theories which is widely utilized as a conceptual framework in the diffusion and adoption of technology (Dooley, 1999; Stuart, 2000). Rogers’ (2003) theory helps to understand the innovation-decision process in which individuals involved. According to Rogers (2003), in the innovation-decision process, there are some stages in deciding to adopt or reject the innovation. These stages are named as knowledge stage, persuasion stage, decision stage, implementation stage, and confirmation stage. Since Rogers’ (2003) theory draws a whole picture for the adoption and diffusion of the innovations, it considers both the characteristics of the innovation and innovativeness of the individuals in the innovation-decision process. In other words, in his theory, Rogers (2003) describes five different perceived attributes of the innovation namely, relative advantage, compatibility, complexity, trialability, and observability. According to Rogers (2003), perceived attributes plays an important role in adopting of the innovation by individuals. However, every individual does not adopt an innovation at the same time. Therefore, based on the innovativeness level, Rogers (2003) groups individuals into the five different adopter categories, namely, innovators, early adopters, early majority, late majority, and laggards. Besides main role of the individuals and the innovation, Rogers (2003) emphasizes role of the communication channels that allows diffusion of the new ideas among the people. Therefore, Rogers (2003) also defines mass media communication channels and interpersonal communication channels used in the innovation-decision process.

In brief then, Rogers' (2003) Diffusion of Innovations theory considering the characteristics of the innovation, the categories of the individuals, and the communication channels helps to explain adoption or rejection of the innovation in the innovation-decision process.

1.2 Significance of the Study

Technology use in education system itself brings changes for schools. Specifically, computers, as an educational tool, arrived in schools with the idea that could be useful in order to make schools more productive and efficient. In addition, computers enable to convert teaching and learning by connecting to real life and prepare young population for the future work fields (Cuban, 2001). From this point of view, large investments were supported by the countries to benefit efficiently from the technology in order to improve students' learning. For example, in Turkey, the Turkish Ministry of Development has allocated 47.886 million Turkish Liras for the 2007-2013 five-year periods and also plans to allocate 66.783 million Turkish Liras for the 2013-2108 five-year periods for the education field. This amount of money has the second biggest investment among the other sectors such as agriculture, energy, mining, tourism, health, and transportation. Moreover, the ministry aims to develop information and communication technology infrastructure in formal and non-formal education institutions as well as to enhance the competencies of students and teachers to use these technologies (Tenth Five Year Development Plan, 2013). However, while some actions towards integrating technology have been taken and lots of money has been spent on technology in schools, it is still a question of adoption of computer technology into the courses and activities (Brown & Warschauer, 2006; Firek, 2002; Ma, Andersson & Streith, 2005). In other words, while technology expenditures have been increasing in schools, unfortunately, the role of technology in instructional settings has not changed (Anderson and Dexter, 2005). The reason of this situation (none or low-level technology use) could be stemmed from presenting technology to teachers without considering their attitudes towards the technology. Indeed, Harper (1987) stated that teacher's attitudes toward computers have been ignored in the previous studies. However, according to Rogers (2003), individuals' attitudes towards to innovation play a crucial role in the innovation-decision process. That is, if teachers have positive views regarding the perceived attributes of computer use, their decision lead them to adopt the computer use. Indeed, some researchers (e.g. Davis, 1989; Francis, Katz, & Jones 2000; Lawton & Gerschner 1982) found that teachers' attitudes toward computers had a significant impact on their behaviors related to computer use for instructional purposes. Moreover, since every individual in a system does not adopt the innovation at the same time, Rogers (2003) emphasizes the role of innovativeness level of people. That is, based on the innovativeness level, adopter categories of the individuals determine people's orientations toward the innovation (Hurt, Joseph, & Cook, 1977). In addition, Rogers (2003) defines diffusion as "the process by which an innovation is communicated through certain channels over time among the members of a social system" (p. 35), therefore the communication channels used in the innovation-decision process are associated with the individuals' orientation (Hurt et al., 1977).

In brief then, Rogers (2003) says that adopter categories of the people and their views regarding perceived attributes of an innovation have a significant role in order to explain adoption and diffusion of an innovation. Moreover, communication channels contribute to each stage of innovation-decision process. Hence, as a theoretical framework, Rogers' (2003) Diffusion of Innovations theory has been used in various studies related to technology use in education. For example, some researchers studied with the faculty employed in universities (e.g. Alhawiti, 2011; Al Senaidi, 2009; Berryhill, 2007; Jacobsen, 1998; Hoskyns-Long, 2009; Knutel, 1998; Keesee, 2010; Laronde, 2010; Less, 2003; Romano, 2010; Sahin, 2006; Waugh, 2002) while others conducted their studies with the teachers working in primary, elementary, secondary, and high schools (e.g. Aşkar & Koçak-Usluel, 2003; Fisher, 2005; Grgurović, 2010; Guggenberger, 2008; Isleem, 2003; James, 2009; Keengwe & Onchwari, 2009; Kuskaya-Mumcu, 2004; Liebermann, 2005; Moore, 2007; Owens, 2009; Rosetti, 2012; Samiei, 2008; Schroll, 2007; Timucin, 2009; Towns, 2010; Urias-Barker, 2000; Walker, 2010). Moreover, accessible literature reveals that few research studies have been conducted on preservice teachers based on Rogers' theory. Moreover, there is little evidence on the studies investigating preservice early childhood teachers' views and intentions (Angeli, 2004; Laffey, 2004; Yelland, Grieshaber, & Stokes, 2000) regarding using computers in early childhood education. Indeed, the existing studies were conducted to the preservice teachers studying in different departments (e.g. Chong, 2012; Kılıçer, 2011; Ogilvie, 2008). To explain, one of the studies investigated individual innovativeness profiles of preservice teachers and examined the barriers to the innovativeness (e.g. Kılıçer, 2011), the other one examined the perceptions of preservice teachers on the use of computer technology and effectiveness of teacher education program (e.g. Chong, 2012). Similarly, another study explored effects of teacher education program in terms of preparing preservice teachers to be innovators (e.g. Ogilvie, 2008).

As it is seen from the previous research, most of the diffusion studies were done for the faculty and in-service teachers. However, since preservice teachers will be in-service teachers in the future, their perceptions and their willingness could give an idea regarding adoption of computers in instructional environments. In other words, identifying favorable or unfavorable attitudes of preservice early childhood teachers towards computer use and taking precautions against unfavorable ones would contribute to the effective use of computers in early childhood education. Since change is difficult for almost any organization but especially for schools as Gooden (1996) states, learning innovativeness level of preservice early childhood teachers and their adopter categories would help to understand their behavioral change. Similarly, analyzing communication channels preferred by preservice early childhood teachers would help to make more rational planning for promoting and diffusion of computer use in early childhood education. Therefore, it is notable to elicit contributions of those three stakeholders (perceived attributes, innovativeness, and communication channels) to explain and to improve the adoption of instructional computer use from the preservice early childhood teachers’ own perspectives.

As a result, in the light of these findings, some inferences related to the idea of adopting the use of computer technology in early childhood education have been presented in terms of researchers, policymakers, and the faculty.

1.3 Purpose and Scope of the Study

As mentioned beforehand, Rogers’ (2003) Diffusion of Innovations theory draws a whole picture for the adoption and diffusion of the innovations including the innovation-decision process. Therefore, based on Rogers’ (2003) theory, the present study aims to achieve four goals. One of these goals is to investigate the preservice early childhood teachers' views related to perceived attributes of instructional computer use in early childhood education. The second goal is to identify the preservice early childhood teachers' innovativeness level and their adopter categories. The third goal is to explore the differences between the adopter categories regarding the perceived attributes of computer use in early childhood education. The last goal is to describe the preservice early childhood teachers' communication channel preferences for learning new information about computer technology.

Within the scope this study, a total of 436 junior and senior preservice early childhood teachers studying at the universities in Ankara were participated. The gathered data were analyzed by descriptive statistical techniques and MANOVA.

1.4 Research Questions

1. What are the preservice early childhood teachers' perceived attributes regarding the instructional computer use?

2. What are the preservice early childhood teachers' innovativeness levels and their adopter categories?

3. Is there a significant difference between the preservice early childhood teachers' adopter categories regarding the perceived attributes of instructional computer use?

4. What are the preservice early childhood teachers' communication channel preferences to learn about computer use?

1.5 Definition of Terms

Innovation: Innovation is "an idea, practice or object perceived as ***new*** by an individual or other unit of adoption" (Rogers, 2003, p.12). In this study, the innovation is "the idea of adopting the use of computer technology in early childhood education".

Perceived Attributes: According to Rogers (2003), **"**the perceived attributes of an innovation are one important explanation of the rate of adaptation of an innovation" (p. 221). In this study, the scale "Turkish version Perceived Attributes of Computer Use (PACU)" is used to examine the five perceived attributes of the innovation. Rogers (2003) states that the five attributes of innovations include: (1)

relative advantage, (2) compatibility, (3) complexity, (4) trialability, and (5) observability.

Innovativeness: Innovativeness is "the degree to which an individual or other unit of adoption is relatively earlier in adopting new ideas than the other members of a system (Rogers, 2003, p. 280).

Adopter Categories: Adopter categories are "the classifications of members of a social system based on innovativeness" (Rogers, 2003, p.267). In this study, the scale "Individual Innovativeness" is used to determine participants' individual innovativeness profiles and the preservice early childhood teachers were categorized in five adopter categories as innovators, early adopters, early majority, late majority, and laggards (Rogers, 2003).

Communication Channels: Communication channel is "the means by which messages get from source to the receiver" (Rogers, 2003, p.217). In nature, there are two main types of communication channel as mass media channels and interpersonal channels.

Mass Media Channels: Mass media channels are "the means of transmitting messages that involve a mass medium such as radio, television, newspapers, and so on, which enables a source of one or a few individuals to reach an audience of many" (Rogers, 2003, p.205). In this study, mass media channels are presented by "television", "printed computer books", "printed computer journals", "online computer books", and "online computer journals".

Interpersonal Channels: Interpersonal channels include "a face-to-face exchange between two or more individuals" (Rogers, 2003, p.205). In this study, interpersonal channels are presented by "interactive computer courses", "friends and family", "seminars and workshops".

Instructional Computer Use: In this study, the term instructional computer use refers to "the use of computer and its software for lesson preparation, lesson delivery, evaluation, communication and administrative record keeping (i.e., grades, attendance)" (Isleem, 2003, p.12).

Perceived Computer Expertise Level: In this study, computer expertise refers to participants' self-perception on their efficiency and effectiveness when using computers (Isleem, 2003). The level of computer expertise of participants is measured by five categories as "very incompetent", "incompetent", "moderately competent", "competent", and "very competent" with respect to their responses.

Preservice Early Childhood Teacher: This term refers to college students who are candidates for completion in an early childhood professional preparation programs (NAEYC, 2012, p.24).

1.6 Limitations

The limitations of this study can be stated as four subjects. First of all, the present study was conducted with the preservice early childhood teachers studying at the universities in Ankara. Therefore, the generalization could be a limitation of this study. Second, this study is limited to all junior and senior preservice early childhood teachers who participated to the research voluntarily. Third, this study is limited to the participants' honest and forthright responses to the questionnaires. Fourth, this study is limited to the participants' accurate answers to the all measures used in this study.

CHAPTER 2

LITERATURE REVIEW

In this chapter, the use of computer technology is reviewed and linked to the present study. For this purpose, firstly, the reasons for using computer technology in education, specifically in early childhood education are explained. Secondly, the improvements regarding the use of computers and related technologies in Turkish education system are provided. Thirdly, theoretical framework of this study, Rogers' (2003) Diffusion of Innovation theory, is explained. Finally, the diffusions studies conducted in literature are presented in detail at the end of the chapter.

2.1 Use of Computer Technology in Early Childhood Education

Today, technology has been considered as a part of daily life (Swedin & Ferro, 2005) and children are growing up in a technology-enhanced environment (Prensky, 2001; Rideout 2011). After diffusion of personal computers in the 1980s, the computers have been commonplace in schools (Bottino, Forcheri & Molfino, 1998). Similarly, in the position statement, National Association for the Education of Young Children (NAEYC) indicated that "computers are integrated into early childhood practice physically, functionally, and philosophically" (1996, p.2). With the advent of computers in education, a great number of research studies have been conducted to investigate effects of computers on education. Specifically, most of the studies were conducted to investigate the effects of computer use on children's social, language, and cognitive skills (Seng, 1998). While some have advocated the educational benefits of them, others have objected to use of computers in early years. Specifically, opponents think that computers and related technologies damaging children's physical, cognitive, social, and emotional development (Healey, 1998;

Cordes & Miller, 2000). For example, according to Maynard (2010), computer activities are developmentally inappropriate for the children from birth to age three since they prevent complex movement and spontaneous dialog. Therefore, Elkind (2007) states that children's computer use are required to be limited as half an hour a day and they should be involved in socially interactive environment. Similarly, Cordes and Miller (2000) state that children can feel pain in their hands, wrists, arms, and neck when they spend much time on computers. Moreover, since computer screens are different from environment light, they can cause vision problems such as burning, tearing, and blurred vision. Therefore, children's visual skills could be affected negatively. Moreover, the opponents think that children exposure unsuitable contents such as sexual and violent while using computer technology (Wartella & Jennings, 2000). For example, Funk (2001) points out very important concerns about increasing of violent video games and it has been said that playing these games may influence children in significant, direful, and full of harm ways. However, it is a fact that playing violent video games possibly will not transform a well-behaved, well-trained child into a bully; however, it will not also diminish aggressive tendencies (Anderson 2002; Anderson & Bushman, 2001, 2002; Bartholow & Anderson, 2002; Chory-Assad, 2000). On the other hand, Yelland (2005) demonstrates that the use of technologies can increase the level of early childhood curriculum and specifically, she illustrated that computer software can supply advantages for teaching abstract mathematical concepts such as shapes which structure the idea that the early childhood curriculum has to be founded on the use of concrete materials. Moreover, according to NAEYC (1996; 2012), when used appropriately, computers support children's cognitive and social development. Indeed, the research, conducted by Li and Atkins (2004), showed that there was a significant relationship between children's experience with the computers and both children's school readiness and cognitive development. For example, Kulik (1994) in his meta-analysis study found that students using computer based instruction from kindergarten to higher education got higher scores on achievement tests, learned in less time, and were more likely to develop positive attitudes. Furthermore, it was found that computers can enable children to practice on arithmetic activities and improve their conceptual skills

(Ayhan, 2005; Clements, 1999; Coskun, 1990; Sancak, 2003; Tanju, 2004). Similarly, in the study, conducted by Alabay (2006), it was found that computer based education had a positive impact on preschool children regarding geometric concepts and the numbers. The researchers also found that while drawing pictures on computers or placing objects on computer screen, they generally narrate what they see or do (Bredekamp & Rosegrant, 1994). Therefore, during computer use, the interaction with their peers enables children to increase their level of spoken communication and cooperation with the others (Clements, 1994; Haugland & Wright, 1997). Moreover, computer games, for example, foster children to use longer and more complex language (Davidson & Wright, 1994). On the other hand, Clements (1999) claims that computers present unique opportunity for children's learning. For example, since computers let users manipulate the objects or the variables, children could experience and discover the actions which are not even possible in real world (Clements, 1999; Seng, 1998). Moreover, the computers offer options and provide freedoms for the children who have different learning styles (Wright, 1994). In addition, Haugland (1992) conducted a study with two groups of children who were three-and four-year-olds and in similar classroom. In one of these groups, children had been using computers while in the other, children had not used. When these two groups were compared, it was found that the children using computers showed higher problem solving skills and conceptualization. Furthermore, according to Haugland (2000), three and four years old children are developmentally ready to explore computers. Indeed, in their report, NAEYC and the Fred Rogers Center for Early Learning and Children's Media (2012) state that preschool and kindergarten children using "traditional" mouse and keyboard computers feel comfortable to use a search engine and websites. After accepting and recognizing the benefits of appropriate computer use in early childhood education, many companies designed instructional computer applications for the children aged from 3 to 8. For example, "I'm Ready for Kindergarten: Huggly's Sleepover" is one of the software for this age group to contribute children's math, reading, map-reading skills, and creativity skills (Haugland, 1999). In the software, children do some activities such as baking pies, designing poster, and creating stories to help main character's sleepover (see Figure 2.1 for screen shot).

Figure 2.1 Screen shot for the "I'm Ready for Kindergarten: Huggly's Sleepover" software.

In brief then, appropriate computer use enhances children's learning and improves their developmental domains (Clements & Sarama, 2002; NAEYC, 1996; 2012). Therefore, computers and related technology could be utilized for a better preparation of new generation (Gates, 2005; Selwyn, Gorard, & Williams, 2001). From this point, most of the countries such as the United States, Spain, the United Kingdom, and Germany have aimed to promote use of technology in their education system (OECD, 2012). Turkey is also one of the countries showing a sharp rise in its technology usage (World Bank, 2008) and has planned to benefit from computer technology in its education system.

2.2 Use of Computer Technology in Turkish Education System

According to report of Organization for Economic Co-operation and Development (OECD), Turkey has shown a sharp increase in its information and communication technology usage in the last decade (OECD, 2005). In Turkey, with the establishment of the “Specialized Commission on Computer Education at Secondary Schools”, the use of technology in the field of education was started by the Ministry of National Education (MoNE) in 1984. In this year, 1100 computers were purchased for the high schools. In the following year, 1111 computers were bought for the 101 secondary schools. Then, in the 1987-1988 academic year, the project “Computer Assisted Education Project” was converted into a pilot project by participating of both domestic and foreign companies (OECD, 2005). In 2000, the World Bank supported project “Catching the Epoch 2000” was implemented as goal of “Basic Education Project (BEP), Phase-I”. For this project, World Bank allocated 600 million USD. Within the scope of this project, 53 schools determined as “Computer Piloting Schools” and 182 “Computer Laboratory Schools” were set up in order to spread use of computers and computer assisted education. Moreover, some training related to information technologies were given to in-service teachers. For example, approximately 56.000 teachers were given face to face training while about 100.000 through distance education (OECD, 2005).

Basic Education Project-Phase I was accomplished in 2003. At the end of the project, 3.188 information technology classes were established and 6.255 projection equipments were placed in primary schools. Moreover, 18.517 overhead projectors and 56.605 computers and other related technologies such as printer and scanner were set up to the primary schools in rural areas (OECD, 2005).

In order to extend goals of Phase-I by covering pre-school education and special education around the country, Basic Education Project-Phase II was planned and implemented in 2004. This project aimed to improve quality of basic education and computer based education and supported by 300 million dollars (OECD, 2005). The project completed in 2007. At the end of the project, 4.002 computer laboratories including computers, printers, scanners, multimedia projectors, and interactive whiteboards were provided to 3.000 schools. Moreover, 70 schools, for special need education, were supplied by computer equipment and appropriate furniture in 44 provinces.

Furthermore, in order to extend use of new technologies at every level of education system, MoNE started a new project. The project “Movement of Enhancing Opportunities and Improving Technology” (FATIH) was planned and prepared by State Planning Organization between 2006 and 2010 years. FATIH project was initiated by Ministry of National Education (MoNE) and supported by The Ministry of Transport. This project aims to equip 42.000 schools and 570.000 classes with the latest information technologies. That is, the schools including preschool education, the primary education and the secondary education will be provided Tablet PCs and LCD Interactive Boards. For this purpose, FATIH project started its first pilot phase as equipping with the Tablet PCs and LCD Interactive Boards to 52 schools. The second pilot phase was launched to set up LCD Interactive Boards in the high schools around the country. Moreover, 8.500 tablet PCs delivered 52 schools in 17 provinces. On the other hand, the third pilot phase was launched to distribute 49.000 tablet PCs to both students and teachers in 81 provinces. FATIH project was planned to be completed in 5 years. For this purpose, high schools and elementary schools are planned to be equipped with hardware and software infrastructure, e-content and teacher's guide books at the end of the second years while primary schools and preschools are planned to be equipped in the third year of the project. Furthermore, within the scope of the project, teachers will be trained to use these technologies in the learning and teaching process, effectively.

As it is seen, by Ministry of Education has taken some actions and spent lots of money to implement technology into the Turkish educational system. However, according to Cavas and his colleagues (2009), teachers’ attitudes have not been sufficiently examined in the initial stages of the implementation. Unfortunately, a similar situation has been occurred in other developing countries (Albirini, 2006; Tella et al., 2007). However, improvement of technology opportunities in the schools does not necessarily enhance classroom teaching practices (Lim & Chai 2008; Lippman, 1997; Ross, Smith, Alberg, & Lowther, 2004; Rutherford 2004; Smeets 2005). Indeed, some research studies show that although computer technologies are effective tools to expand the educational opportunities, teachers are not using them for instructional purposes (Bauer & Kenton, 2005; Cuban, 2001). Therefore, since teachers play key role in the use of computer technology in education (OTA, 1995; Zhao & Tella, 2002), they should be considered as a main component of education system. According to Rogers' (2003) Diffusion of Innovations theory, members of a social system could show favorable or unfavorable attitudes towards an innovation. What is more, individuals' attitudes are indispensable to adopt or reject the innovation (Rogers, 2003). In brief then, to consider teachers' attitudes could lead a rational computer use in education.

2.3 Diffusion of Innovations Theory

Rogers' (2003) Diffusion of Innovations theory has been used by a variety of disciplinary fields such as education, communication, anthropology, geography, medicine, marketing, sociology, and political science (Dooley, 1999; Stuart, 2000). For example, in marketing and management, individuals or customers have been studied for the innovations such as a coffee brand, clothing fashions, mobile telephone, and so on. Similarly, in medicine field, individuals and organizations from hospitals or health departments have been studied for the innovations such as drugs, family planning methods, AIDS prevention, and the like. On the other hand, in education, most of the studies have been conducted to investigate teaching and learning innovations such as classroom management system, programmed instruction, and instructional technology with the participants from education systems (Rogers, 2003). Indeed, Rogers' (2003) theory is considered as the most appropriate theory to explore the adoption of technology in educational settings (Medlin, 2001; Parisot, 1995). For example, Carlson (1965) examined diffusion of modern math (programmed instruction) in Pennsylvania and West Virginia. For this purpose, he investigated school administrators' innovativeness and perceived attributes of the innovation (modern math) with its rate of adoption. He gathered data from thirty-eight participants by personal interviews. The process was occurred when one school principal adopt the modern math. Then, this innovator travelled outside of the areas and served as a role model for the other school administrators. Focusing on interpersonal networks, modern math was adopted and diffused 100 percent about five years later. Moreover, Rogers' (2003) theory was utilized for the diffusion of initiatives carried out by the governments (e.g. Berman & Mclaughling, 1974; 1975; 1978).

Rogers (2003) defines diffusion as "the process by which an innovation is communicated through certain channels over time among the members of a social system" (p. 11). In other words, diffusion is a special type of communication in which the individuals construct and allot information about new ideas from one to another. An innovation is "an idea, practice or object perceived as new by an individual or other unit of adoption" (Rogers 2003, p.36). That is, the newness depends on the individual whether to perceive it as innovation or not. Therefore, the innovation does not entirely require a new knowledge. For example, the members of a system may have known about the innovation in a time, however, may not have developed any positive or negative attitude toward it. Thus, the individuals would not have a decision to adopt or reject the innovation. In order for the individuals to decide adoption or rejection of an innovation, a series of actions are required. This is called as "innovation-decision process". According to Rogers (2003), the innovation-decision process is the process "through which an individual (or other decision-making unit) passes from gaining initial knowledge of innovation, to forming an attitude toward the innovation, to making a decision to adopt or reject, to implementation of the new idea, and to confirmation of this decision" (p. 168). As it is understood from the definition innovation-decision process includes a model of five stages, namely knowledge, persuasion, decision, implementation, confirmation and a social change occurs in the structure of social system during the invention, diffusion, adoption or rejection of the new ideas (Rogers, 2003) (see Figure 2.1).

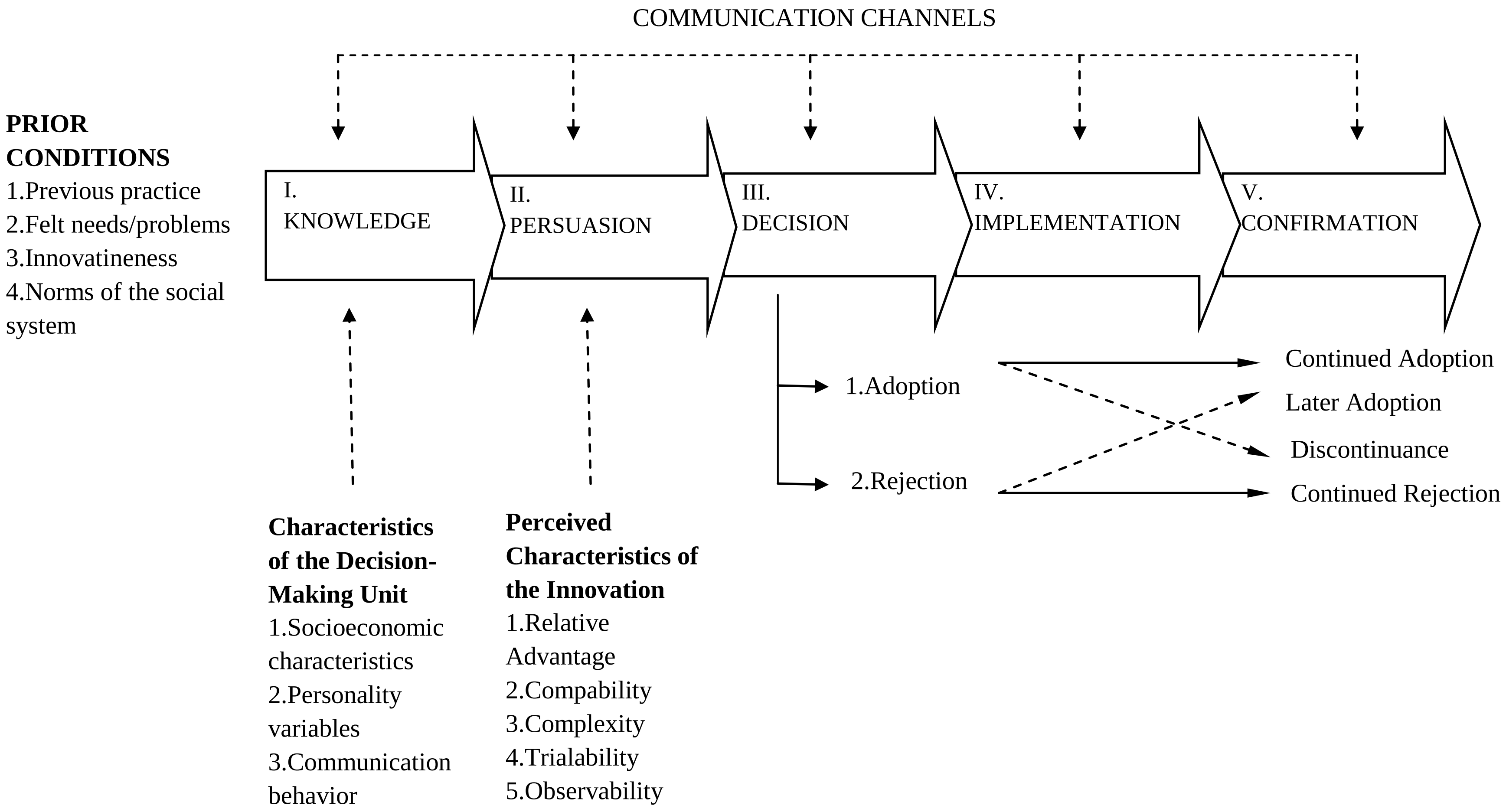


Figure 2.1. A Model of five stages in the innovation-decision process (Rogers, 2003)

As illustrated in Figure 2.1, the five stages model presents a basis understanding for the complex behavior change in terms of adoption/rejection of an innovation. To explain each stage, in the knowledge stage, the individual gains information about the innovation. There are three types of knowledge about the innovation such as awareness-knowledge, how-to knowledge, and principles knowledge. In this stage, the individual learns about the innovation, the use of the innovation, and the procedures related to work of the innovation (Rogers, 2003). Secondly, in the persuasion stage, the individual improves a general perception about the innovation. After gaining knowledge about the innovation, individual considers whether the innovation provides advantage or disadvantage to her/him. Therefore, while knowledge stage requires mental activities, the persuasion stage is mainly based on psychological activities. Moreover, in this stage, perceived attributes of the innovation play important role to form an attitude toward the innovation (Rogers, 2003). Thirdly, in the decision stage, the individual decides to either adopt or reject the innovation. The significant part of this stage is being able to try the innovation. In other words, if the individuals have trial opportunity for the innovation and if they believe that the innovation provides advantages, then they make adoption decision. Moreover, demonstrations showing how the individuals use the innovation could be utilized as an effective method for making adoption decision. On the other, the individuals can reject to adopt the innovation. There are two types of rejection as active rejection and passive rejection. To explain, active rejection means that the individual first decides to adopt the innovation, however, and then decides not to adopt it. On the other hand, passive rejection means that the individual never think to adopt the innovation (Rogers, 2003). Fourthly, in the implementation stage, there is an action and behavior change. In other words, after deciding to use the innovation, the individual put it into practice. Therefore, technical support is important in this stage. Depending on the nature of the innovation, length of the implementation stage may change. Moreover, when the innovation loses its newness identity, this situation can be resulted by completion of implementation stage. At the end, while some adopters close the innovation-decision process, others pass a further stage of confirmation (Rogers, 2003). Finally, in the confirmation stage, the individual looks for reinforcement in order to maintain her/his decision and aims to clarify conflicting messages. Therefore, in order to prevent any dissonance, the individual strives to get supportive messages. At the end, the individual could be in four positions such as continued adoption, later adoption, discontinuance, and continued rejection. To expound, if the individual decide to adopt the innovation or the new idea at the decision stage, s/he may either continue the adoption decision (continued adoption) or give up her or his adoption decision (discontinuance). On the other hand, if the individual decide to reject the innovation or the new idea at the decision stage, s/he may either continue the rejection decision (continued rejection) or change her/his rejection decision and begin to adopt it (later adoption) (Rogers, 2003).

2.3.1 Communication channels and innovation-decision process.

Rogers (2003) defines communication channel as “the means by which a message gets from one individual to another” (p. 18). Communication channels can be categorized as mass media versus interpersonal and localite versus cosmopolite.

Mass media channels refer to the means that make enable to reach a large audience in a short time. To give example, mass medium could be television, radio, newspaper, journals, and the like. Moreover, mass media channels are effective medium to create awareness about the innovation. Therefore, the mass media messages have an influence on initial beliefs of the individuals. Hence, they are mostly used in the knowledge stage of innovation-decision process. On the other hand, interpersonal channels are the means where the messages transmit with a face-to-face interaction. That is, interpersonal channels provide a two-way communication between two or more individuals. Therefore, they play very important role to affect resistant individuals to adopt the innovation. In other words, they are mostly used in the persuasion and decision stages of the innovation-decision process (Rogers, 2003).

Communication channels have different role for the each stage of the innovation-decision process. For example, while mass media channels are more important at the knowledge stage, interpersonal channels are more important at the persuasion stage. Similarly, while cosmopolite channels are more important at the knowledge stage, localite channels are more important at the persuasion stage (Rogers, 2003).

2.3.2 Innovativeness and adopter categories.

Rogers (2003) describes innovativeness as “the degree to which an individual or other unit of adoption is relatively earlier in adopting new ideas than the other members of a system (p. 280). Innovativeness is considered as main objective of the most diffusion programs and it has a role as indicator of the behavioral change. Since every individual in a social system does not adopt an innovation at same time, the individuals are categorized into adopter categories. In other words, members of system are classified into adopter categories, based on their innovativeness. What is more, the same innovation may be favorable for one potential adopter while may be undesirable for another adopter. Therefore, each adopter categories include the individuals having similar degree of innovativeness (Rogers, 2003). In a system, the cumulative distribution of adopters draws an S-shaped curve for the successful innovation. That is, at the beginning, there are a few adopters who adopt the innovation and the curve rises slowly. Then, the curve increases at maximum level until half of the individuals have adopted the innovation. After that, the curve shows a slow rise since fewer and fewer individuals remain to adopt the innovation (see Figure 2.2).

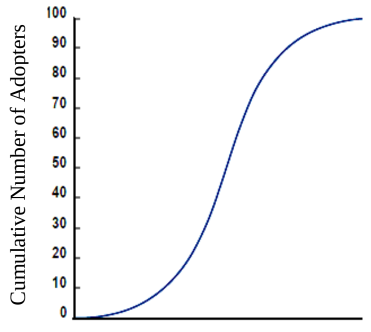


Figure 2.2. Cumulative number of adopters by time (Rogers, 2003)

Rogers (2003) defines five categories that are innovators, early adopters, early majority, late majority, and laggards.

Innovators (Venturesome): The characteristic of the innovators is venturesomeness. In other words, they willing to take risks and experience new things. Moreover, they are able to deal with the high uncertainty about the innovation when they adopt it. Furthermore, they willing to adopt the innovation whether it is succeed or not. Although the other members of the system might not respect to them, the innovators play a leading role for the flow of new ideas into a system. Therefore, they are considered as a gatekeeper in the diffusion process (Rogers, 2003).

Early Adopters (Respect): The characteristic of the **e**arly adopters is being respected by other members of the system. They are perceived as “the individual to check” by many others. In other words, they have an important influence on their peers in terms of adopting the new ideas. Therefore, they are considered as leader in the diffusion process (Rogers, 2003).

Early Majority (Deliberate): The characteristic of the **e**arly majority is to adopt new ideas with a deliberate willingness. They do not be the neither first nor the last who adopt the new things. In other words, they adopt the innovation just before the average in a system. Although they make an important link between the earlier and the later, they rarely lead the other members of the system (Rogers, 2003).

Late Majority (Skeptical): The characteristic of the late majority is being skeptical about the new ideas. In other words, they need to feel the innovation safe and they should be convinced about it. Moreover, they usually wait until the most of the individuals adopt the innovations. Therefore, they are the members who adopt new ideas just after the average in a system (Rogers, 2003).

Laggards (Traditional: The characteristic of the laggards is being traditional. In other words, their decisions are usually referenced by previous opinions and traditional values. They are the last to adopt new ideas in a system. They must have certain information about the innovation which was successfully applied before (Rogers, 2003).

According to Rogers (2003), in a social system, these five categories distribute in different percentages. For example, 2.5% of the individuals are placed in innovators group while 13.5% of them are early adopters. Moreover, both early majority and late majority group have same percentages as 34% in a social system. The rest of the individuals are grouped in laggard (16%) (see Figure 2.3).

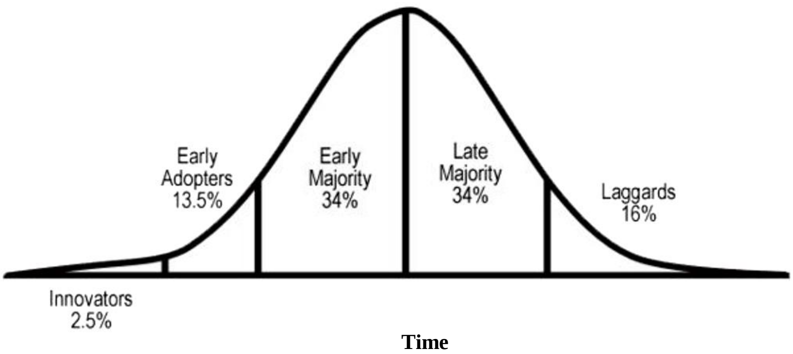


Figure 2.3. Adopter categorization based on degree of innovativeness (Rogers, 2003)

Moreover, Rogers (2003) indicates that adopter categories are different from each other in terms of socioeconomic status, personality values and communication behavior. To begin with socioeconomic status, Rogers (2003) says that earlier adopters are more educated and wealthier than are later adopters. Moreover, earlier adopters have higher social status regarding income, level of living, occupational prestige and so on. Furthermore, earlier adopters have larger-sized units, which are farms, schools, companies, and the like, than do later adopters. On the other hand, earlier adopters do not differ than later adopters in age. Secondly, regarding adopters' personality variables, the generalizations show that earlier adopters have greater ability to cope with abstractions and uncertainty than do later adopters. Furthermore, earlier adopters have more positive attitude toward change as well as toward science. In addition, earlier adopters are more intelligent and more rational than are later adopters. Moreover, earlier adopters have greater empathy and greater self-efficacy than do later adopters. On the other hand, earlier adopters are less dogmatic and less fatalistic than are later adopters (Rogers, 2003). Lastly, adopter categories show differences regarding communication behavior too. For example, earlier adopters investigate about the innovation more actively and have greater exposure to both mass media and interpersonal communication channels. Moreover, they have greater knowledge about the innovation than do later adopters. Furthermore, earlier adopters have more social participation and they have higher degree of opinion leadership rather than later adopters (Rogers, 2003).

2.3.3 Attributes of innovation.

According to Rogers (2003), all of the innovations are not diffused and adopted in desirable way. That is, while some innovations diffuse widespread at the time that they first introduce, the others either take long time or ever spread. Rogers (2003) describes rate of adoption as "the relative speed with which an innovation is adopted by members of a social system" (p.221). Hence, the rate of adoption of an innovation is affected by some variables such as perceived attributes of innovation, type of innovation decision, communication channels, nature of social system, and the extent of the change agents' promotion efforts (see Figure 2.4).

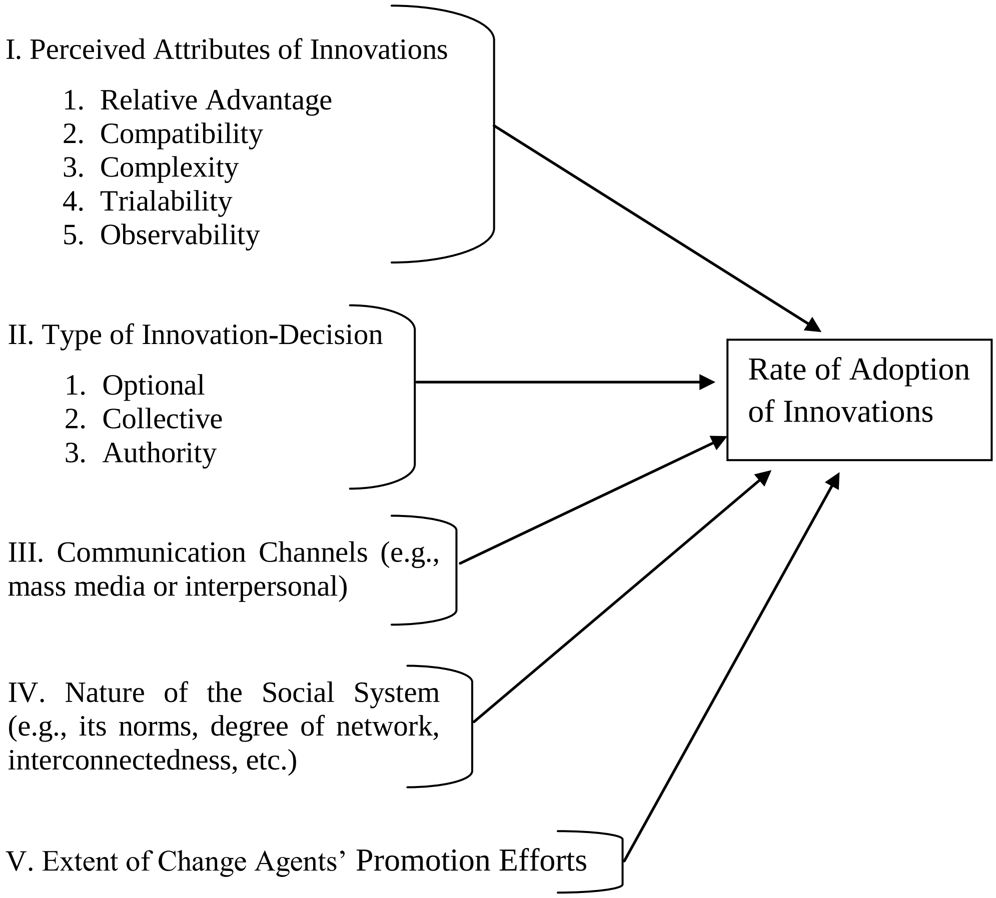


Figure 2.4 The variables affecting the rate of adoption (Rogers, 2003)

However, these five types of the variables have not equal variance to explain the rate of adoption. In other words, the perceived attributes of innovation was found that it has about half of the variance among the others (Rogers, 2003). Therefore, the present study will mostly examine the perceived attributes of innovation in order to determine an innovation's rate of adoption. Rogers (2003) describes five attributes which are relative advantage, compatibility, complexity, trialability, and observability based on past writing and research. These five characteristics of innovations are considered as having maximum universality and conciseness. In order for the adopters to decide whether adopt or reject an innovation, perceived attributes of the innovation play an important role.

Rogers (2003) defines relative advantage as “the degree to which an innovation is perceived as being better than the idea it supersedes” (p. 229). In other words, it means that in which degree a new idea is better than an existing one. The degree of relative advantage could be change regarding the nature of the innovation as well as characteristics of the potential adopters. Specific types of relative advantage are mostly expressed as social prestige, economic profitability, comfort, saving of time, saving of effort, and the like. The relative advantage has been found one of the strongest predictor by diffusion scholars. Moreover, research findings showed that the relative advantage is positively related to its rate of adoption (Rogers, 2003).

Moreover, Rogers (2003) says that compatibility is “the degree to which an innovation is perceived as consistent with the existing values, past experiences, and needs of the potential adopters” (p. 240). That is, if an innovation is more compatible, then it is less uncertain and it fits close individual’s situation. Thus, an innovation can be either compatible or incompatible with the individuals’ sociocultural values and beliefs, previous ideas, and the needs for the innovation. To explain, the resistance of adopting the innovation would be strong when the innovation is perceived as incompatible with a person’s values and beliefs. On the other hand, possibility of adopting the innovation would increase, if the innovation is perceived as familiar and necessary for the members of the society. In brief then, the compatibility of an innovation is positively related to its rate of adoption (Rogers, 2003).

On the other hand, complexity is “the degree to which an innovation is perceived as relatively difficult to understand and use” (Rogers, 2003, p. 257). Therefore, it plays an important role to be a barrier for the adoption of an innovation. In other words, the complexity of an innovation is negatively related to its rate of adoption (Rogers, 2003).

The other attribute, trialability, is defined as “the degree to which an innovation may be experimented with on a limited basis” (Rogers, 2003, p. 258).

Although some innovations are more difficult to try than others, a personal trial can eliminate ambiguity about new ideas. In other words, if people are able to try an innovation, they gain more information about how it works and they find it more meaningful. Hence, the trialability of an innovation is positively related to its rate of adoption (Rogers, 2003).

The last attribute, observability, refers to “the degree to which the results of an innovation are visible to others” (Rogers, 2003, p. 258). That is, if an innovation is easy to observe and to communicate to other individuals, it is generally adopted rapidly. Thus, the observability of the innovation is positively related to its rate of adoption (Rogers, 2003).

As a result, the five characteristics of innovations, explained above, are the most important components of the rate of adoption. Moreover, the innovation having greater relative advantage, compatibility, trialability, and observability and less complexity refer more rapidly adoption than other innovations (Rogers, 2003).

Although these attributes are conceptually different from each other, each one is related to the other four. In order to measure the attributes of innovations and examine the rate of adoption, researchers use Likert-type scale items to gather participants’ responds (e.g. Moore & Benbasat, 1991; Holloway, 1977; McQuiggan, 2006; Keesee, 2010; Rosetti, 2012). In general, it is advised that the diffusion scholars should prepare their own scale for the purpose of the study rather than using the existing one. However, the scale which was developed by recommends Moore and Benbasat (1991) is recommended with proper adaptation for any particular innovation and any participants (Rogers, 2003). Indeed, this scale was utilized for the purpose of the present study.

2.4. Related Studies Based on Diffusion of Innovation Theory

Scholars conducted different aspects of the diffusion of innovation theory and they also studied effects of some variables on the elements of the theory. These related studies conducted in education field were explained in detail. For this purpose the studies were divided in three subtitles as following.

2.4.1. Related studies based on perceived attributes.

Although up to 87 percent of rate of the adoption belongs to the perceived attributes of innovations (relative advantage, compatibility, complexity, trialability, and observability), according to Rogers (2003) approximately 1 percent of the diffusion publications have been studied about perceived attributes. The following of this part presents the studies only conducted in education field.

To begin with, Aşkar and Koçak-Usluel (2003) conducted a longitudinal study to explore rate of computer adoption during two years. Previously, twenty-seven primary teachers were interviewed from three schools, and then thirty-one primary teachers were interviewed from the same schools. Data were analyzed by content analysis method. At the end of the study, the results showed that relative advantage and observability made differences on the rate of computer use adoption.

In the other study, Moore (2007) investigated the integration of the standards for technological literacy in the curriculum in her dissertation. The study was designed as a quantitative research and the data were obtained from one hundred sixty-six technology education teachers by e-mail survey. The data were analyzed by correlational analysis in order to determine the relationships between the attributes and the standards for technology literacy. At the end of the study, majority of teachers perceived that relative advantage, compatibility, and being easy (complexity) were important to use of the standards in the classroom.

In his dissertation, Brahier (2006) explored the adoption of digital annotations, RepliGoTM, and the factors affecting the use of digital annotations in the classroom settings. Moreover, perceived attributes of the innovation were determined. For the study, data were gathered from sixty teachers by both surveys and interviews. At the end of the study, relative advantage, compatibility, and trialability were found as a dominant attributes in the adoption process.

Kuşkaya-Mumcu (2004) aimed to examine diffusion of information technology in vocational and technical schools in her thesis. Specifically, the study explored the perceived attributes of information technology use and variance of the perceived attributes as predictors of instructional, managerial and personal usage. For these purposes the study was designed as descriptive and associational study. The data were obtained from four hundred and twenty-five vocational and technical teachers by survey and analyzed by descriptive statistical techniques and stepwise regression method. The findings of the study revealed that information technology was mostly used for managerial purposes and rarely used for instructional purposes. Furthermore, the use of information technology provided relative advantage, compatibility, and observability to teachers whereas it was not perceived as difficult by teachers. Therefore, a positive relation was established between the relative advantage, compatibility, observability and the use of information technology while a negative relation was found between complexity and the use of information technology. In addition, the complexity was the most predictive variable among the other perceived attributes regarding the use of information technology for teachers.

In his dissertation, Isleem (2003) examined the relationships between the level of computer use for instructional purposes and the variables such as expertise, access, attitude, support, and teacher characteristics. The study was designed as a survey-correlation research and data were gathered from seven hundred and seventy-two technology education teachers. The data were analyzed by descriptive and inferential statistical techniques. The results showed that a strong positive correlation occurred between the level of computer use and both of teachers' computer expertise and teachers' attitude toward computers. Moreover, a moderate positive correlation occurred between the level of computer use and access to computers. In addition, the greatest amount of variation in the level of computer use was found as computer expertise, attitude toward computer, and computer access, respectively.

Moreover, Grgurović (2010) investigated how technology-enhanced blended learning (a combination of face-to-face and online instruction) was perceived for teaching English in her dissertation. The study was designed as case study methodology including both qualitative and quantitative data. For this purpose, the data were gathered from two teachers and thirty-one students. The study found that teachers perceived the innovation as relative advantage in terms of its plenty of online materials, diversity of exercises, and time saving characteristics. Moreover, the teachers perceived it as compatible to their needs. Furthermore, the teachers would find opportunities to try the innovation in workshops or by self-experiment and would make possible to be observed. On the other hand, for both students and teachers, the innovation has some difficulties because of technical problems.

2.4.2 Related studies based on adopter categories.

According to Rogers (2003) more than half of the diffusion studies were conducted on innovativeness of the individuals which is used to determine adopters' categories and characteristics. Similarly, in education field, much research was studied the innovativeness and adopter categories variables to understand characteristics of the potential adopters.

For example, Berryhill (2007) examined adopter status of faculty regarding the use of instructional technology in the technology classrooms in her dissertation. Specifically, the study aimed to determine whether faculty perceive themselves as adopter or non-adopter in the use of instructional technology. In addition, the study aimed to investigate the relationship between the demographic variables (age, gender, race, and teaching years) and the adopter status. For these purposes, Berryhill (2007) designed a quantitative research and conducted an online survey to six hundred and fifteen faculty members. After obtaining data, correlation coefficient and descriptive statistics were used to analyze data. The results indicated that most of the participants perceived themselves as adopters of the instructional technology in the technology classrooms. Moreover, there was no relationship between faculty's adoption/non-adoption status and their demographic variables such as gender, race, teaching years, and age.

In the other study, Jacobsen (1998) investigated adopter categories of faculty regarding their innovativeness and the difference between the early adopters and mainstream (both early majority and late majority) faculty in her dissertation. For this purpose, the study was designed as mixed-method using both quantitative and qualitative research. For quantitative data, an online survey was utilized to seventy-six faculty and the data were analyzed by descriptive and explanatory statistical analyses. Moreover, for qualitative data, semi-structured interview were conducted to seven faculty and the data were analyzed by creating categories and themes. At the end of the study, some differences were found between early adopters and mainstream faculty. For example, while both early adopters and mainstream faculty had computers, early adopters used computers much more in a day than do mainstream faculty. Moreover, early adopters' level of computer expertise and level of innovativeness was higher than mainstream faculty. Furthermore, early adopters were more confident and more inclined in terms of integrating technology in their courses than mainstream faculty.

In his dissertation, Demuth (2010) conducted a quantitative research to examine technology adoption by faculty, support staff, and university students. Specifically, purpose of this study was to find whether Rogers' categories of innovator, early, early majority, late majority, and laggard adopters could be applied to information technology application in universities. For this purpose, Demuth (2010) applied a survey research to five hundred and thirty-four participants from five colleges and used t-test, correlation, and regression analysis to analyze data. Results of the study showed that while late majority group was not significant variable in estimating the adoption of technology, innovators, early adopters, early majority, and laggards were significant variables to estimate the adoption of technology in university.

Al-Senaidi (2009) aimed to examine adopter categories of faculty and the factors affecting adoption of information and computing technology in his dissertation. For this aim, the study was designed as survey research and three hundred faculty members were participated to the study. The data were analyzed by descriptive statistics and one-way ANOVA. The results revealed that early adopters used information and computing technology more than later adopters. Moreover, early adopters had higher information and computing technology skills and higher values of information and computing technology attributes than later adopters. Furthermore, early adopters felt fewer barriers in the adoption of information and computing technology.

The other study, conducted by Liebermann (2005), examined the status of the adoption of computer technology in the fields of teaching and coaching volleyball. The study was designed as a survey research and the data were gathered from one hundred and twenty-five physical education teachers and volleyball coaches. The data were analyzed using t-test and correlation. The results indicated that while almost all of the educators used computer for general purposes, more than half of them did not use computers for specific purposes within physical education and sport field.

Another important study was conducted by Timucin (2009) to investigate the implementation of Computer Assisted Language Learning (CALL) in English language teaching context. For the study, fourteen teachers were interviewed and the data were analyzed by content analysis. The result showed that most of the teachers were grouped in risk aversive group. Moreover, the teachers in this group had higher teaching years and less computer skills, needed more encouragement.

Less (2003) aimed to investigate adoption computer technology by faculty. Specifically, the study explored adopter categories of the faculty and effects of demographic variables on adopter categories. The study was designed as a causal-comparative research and the data gathered by online survey. The results indicated that the variables such as teaching experience years and highest degree attained made significant difference on the adopter categories.

Esen (2002) conducted a quantitative research to investigate adopter categories of university students and adoption of VCD films among them. For the study, the data were obtained from two hundred and eighty-nine participants. The participants were categorized by three adopter categories, namely, innovators, early majority and late majority. Moreover, among these groups, innovators showed that they had higher education level and had more technology than early majority and late majority.

In his dissertation, Kılıçer (2011) explored individual innovativeness profile of preservice computer education and instructional technology teachers. Moreover, the study examined the effects of the independent variables on level of innovativeness. For this quantitative study, data were gathered from seven hundred and eight-two participants and the data were analyzed by t-test and one-way ANOVA. The results indicated that most of the participants had high level of individual innovativeness. Moreover, the independent variables such as level of technology usage, frequency of technology usage, access to technological facilities, membership to social networks made a significant effect on level of individual innovativeness.

Waugh (2002) explored adopter categories and personal characteristics of faculty in her dissertation. Moreover, the study investigated the effect of personal characteristics on adopter types for estimating adoption of technology. For this purpose, Waugh (2002) designed a quantitative research and the data were obtained from four hundred and thirteen faculty members by mail survey. Then, the data were analyzed by descriptive and inferential statistics. At the end of the research, first, the faculty members were categorized as earlier adopters and later adopters. Then, the effects of independent variables were tested for adopter types. The result of the study showed that age and subject area had a significant effect while gender and academic rank did not have a significant effect for estimating technology adoption.

Romano (2010) explored the differences between two adopter categories that are early adopters and late majority regarding the use of technology in her dissertation. The study was designed as a mixed methods research and the data were gathered from twenty-two faculty by survey and a following interview. The data were analyzed by descriptive statistics. In order to determine differences between early adopters and late majority, some variables were compared and results showed that age and number of years at the university made a difference between early adopters and late majority faculty.

2.4.3 Related studies based on adopter categories and perceived attributes.

Since every member of a system perceive the attributes of the innovation differently (Rogers, 2003), some researchers have also investigated both adopter categories of the individuals and perceived attributes of the innovations. These studies, conducted in education field, were illustrated in the following part.

In his dissertation, Lu (2006) conducted a qualitative research to examine the factors that affect the diffusion of wireless Internet technology among the university faculty. For the study, the data were gathered by observations, in-depth semi-structured interviews, and documentation from sixteen faculty members and 7 administrators. Findings from this study showed that early adopters and the mainstream (early majority and late majority) were different from each other in terms of teaching practices and teaching philosophy, knowledge and skill of technology, technology needs, and communication channels.

Sahin (2006) aimed to explore faculty's level of instructional computer use and the relationships between the variables and level of use. For this aim, the study was designed as a quantitative research and the data were gathered from one hundred and fifty-seven faculty members by survey. To analyze data, descriptive and inferential statistics techniques were used. At the end of the study wide variety of findings were reported. To begin with, the results showed that the faculty had low level of use and expertise. Second, some variables such as, computer ownership, computer access, computer experience year, barriers, support, attitude toward computer use, and adopter categories were significantly correlated with level of instructional computer use. Third, the results indicated that the faculty who had computer, who had computer experience between 16 and 20 years, and over the 20 years had higher instructional computer use. Finally, the faculty who were innovator, early adopters, and early majority group had higher instructional computer use.

In her dissertation, Rosetti (2012) intended to examine frequency of interactive whiteboards use before and after ready-made lessons. For this purpose, a quantitative experimental study was designed and the data were gathered from fifty-six prekindergarten teachers by online survey. The data were analyzed by descriptive statistics, t-test, and multiple regression analyses. To explore the effect of ready-made interactive whiteboard lessons on frequency of time of interactive whiteboards use, t-test was conducted. Moreover, variance of the variables such as perceived attributes, adopter categories and demographic information for predicting frequency of interactive whiteboards use was examined by linear and multiple regression. The findings showed that teachers showed positive perceptions about the attributes of interactive whiteboards. Moreover, teachers used interactive whiteboards more frequently after the treatment. The interesting result was the adopter categories of the prekindergarten teachers. That is, most of them were in laggard group, and then in early majority and early adopters, respectively. Furthermore, the result indicated that complexity and trialability were significant predictors of the adopter category.

The other study, conducted by Keesee (2010), aimed to investigate adopter categories of faculty and their perceived attributes of course management systems (CMS) in her dissertation. Moreover, the study explored which perceived attributes were predictors of adopter categories. The study was designed as a quantitative non-experimental research and the data were gathered from one hundred and thirty-seven full-time faculty members by using online survey. To analyze the data, descriptive statistics and logistic regression analyses were conducted. The results showed that majority of the participants were early adopters, and then, innovators and early majority, respectively. Moreover, the least percentage belonged to both late majority and laggards. In order to determine predictors of adopter categories, the perceived attributes of CMS that are relative advantage, compatibility, complexity, trialability, and observability were assigned as independent variables. The findings demonstrated that perceived attributes predicted differently for each adopter categories. For example, compatibility and complexity were predictors for innovators; relative advantage, complexity, and observability were predictors for early adopters; complexity was the predictor for early majority; compatibility, complexity, trialability, and observability were predictors for late majority; relative advantage, compatibility, and complexity were predictors for laggards.

2.5 Summary

Literature revealed that new generation are growing up with computers and related technologies (Prensky, 2001). Therefore, Prensky (2001) identifies this new generation as “Digital Natives” which refers to native speakers of digital world. Moreover, the studies showed that computers and related technologies have a significant effect on teaching and learning (Clements 1994, Clements, Nastasi, & Swaminathan, 1993; Clements & Sarama, 1998, 2002; Haugland 1992; Haugland & Wright, 1997; McCarrick & Li, 2007; McKenney & Voogt, 2009; NAEYC, 1996; Shade 1994; Plowman & Stephen, 2003; Vernadakis, Avgerinos, Tsitskari, & Zachopoulou, 2005) and they are indispensable to the 21st work place (OECD, 2006). When countries become aware of this reality, they have accordingly developed and applied their technology and innovation policies (OECD, 2012). Turkey is one these countries that desires to use technology in education (MoNE, 2012; World Bank, 2008). However, purchasing technology may not be enough in order to design an effective learning environment, (Lippman, 1997). In education system, teachers play a crucial role (Zaho &Tela, 2002) so that they should be considered for a successful technology use (OTA, 1995). For this purpose, Rogers’ (2003) Diffusion of Innovations theory could be utilized as a theoretical framework to examine technology adoption practices in education (Medlin, 2001; Parisot, 1995). Indeed, many diffusion studies used Rogers’ (2003) theory to investigate adoption and diffusion of computer and the related technology (e.g. Alhawiti, 2011; Al Senaidi, 2009;Aşkar & Koçak-Usluel, 2003; Berryhill, 2007; Chong, 2012; Fisher, 2005; Grgurović, 2010; Guggenberger, 2008; Isleem, 2003; Jacobsen, 1998; James, 2009; Hoskyns-Long, 2009; Keengwe & Onchwari, 2009; Keesee, 2010; Kılıçer, 2011; Knutel, 1998; Kuskaya-Mumcu, 2004; Laronde, 2010; Less, 2003; Liebermann, 2005; Moore, 2007; Ogilvie, 2008; Owens, 2009; Romano, 2010; Rosetti, 2012; Sahin, 2006; Samiei, 2008; Schroll, 2007; Timucin, 2009; Towns, 2010; Urias-Barker, 2000; Walker, 2010; Waugh, 2002). However, the accessible literature revealed that none examined adoption and diffusion of instructional computer use by preservice early childhood teachers. On the other hand, since preservice teachers will be in-service teachers in the future, their favorable or unfavorable attitudes towards computer use, their innovativeness level, and their communication channel preferences would help to understand their behavioral change and to make a more rational planning for promoting and diffusion of computer use in education system. Therefore, the present study including three components of the Rogers' (2003) Diffusion of Innovations theory aimed to investigate the adoption of computer use by preservice early childhood teachers.

CHAPTER 3

METHODOLOGY

In this chapter, research methodology of the current study is presented. First, design of research is presented with correspondent research questions. Secondly, population and sampling procedure is explained with the external validity of the study. Thirdly, instrumentation and the development process are elucidated ensuring validity and reliability issues. Fourthly, data collection procedure is clarified handling internal validity threats and ethical issues. Finally, data analysis procedure is explicated demonstrating variables and the related analysis.

3.1 The Aim of the Study

The present study aims to investigate and describe the preservice early childhood teachers views related to instructional computer use in early childhood education, their individual innovativeness profiles, and their background information (age, gender, grade level, socioeconomic status, computer/Internet access, attending course or seminar, computer usage year, computer expertise level, their technology preferences for their future teaching settings, their communication channel preferences for obtaining new information about technology). Moreover, the present study aims to examine the factors that might be associated with adoption of computer use. In addition, this study aims to investigate the differences between preservice early childhood teachers' views related to instructional computer use in early childhood education and their individual innovativeness profiles.

3.2 Research Questions

To accomplish purposes of this study, four research questions are addressed:

1. What are the preservice early childhood teachers' perceived attributes regarding the instructional computer use?

2. What are the preservice early childhood teachers' innovativeness levels and their adopter categories?

3. Is there a significant difference between the preservice early childhood teachers' adopter categories regarding the perceived attributes of instructional computer use?

4. What are the preservice early childhood teachers' communication channel preferences to learn about computer use?

According to Fraenkel and Wallen (2006), survey research is used to figure out the specific characteristics of a group and causal-comparative research methodology is used to compare two or more groups of subjects. As presented Table 3.1, considering research questions of the study and definitions of research design, the present study is harmony of survey and causal-comparative research methodology.

Table 3.1

Research Design of the Study

Research Questions	Research Type	Research Methodology	Quantitative versus Qualitative
RQ1, RQ2, RQ4	Descriptive Study	Survey Research	Quantitative
RQ3	Associational Study	Causal-Comparative Research	Quantitative

3.3 The Population and Sampling

The target population of the study includes all junior and senior preservice early childhood education teachers in Ankara. However, since only volunteer participants who were present during the survey were attended the study, the accessible population has been defined as 436 junior and senior preservice early childhood education teachers attending the study in Ankara (see Table 3.2).

Table 3.2
Frequency of the Participants

University Name	Junior	Senior	Total
A	19	19	38
B	54	55	109
C	120	57	177
D	65	47	112
Total	258	178	436

3.3.1. Sample selection procedure.

Fraenkel and Wallen (2006) mentioned that the vast majority of research conducted in education use nonrandom samples since sometimes it is not feasible or not possible to get a random sample. In this study, nonrandom sampling methods were used to select participants for two reasons. Firstly, as Fraenkel and Wallen (2006) stated, obtaining a random sample may not feasible in terms of the time, money, or other resources. Because of these reasons, the universities which are in Ankara were conveniently determined for the study. In Ankara, there are seven private and four public universities (OSYM, 2010). However, since all of the private universities do not have the Early Childhood Education department, in total, one private and four public universities were included in the present study.

Secondly, as Fraenkel and Wallen (2006) stated, obtaining a random sample may not possible since participants should have some special qualifications of some sort. Therefore, from this convenience sample, junior and senior preservice early childhood teachers were purposively selected for the study. The purpose to select this sample is that they have already taken courses related to the technology and school experience. To exemplify, students take “Computer I” course in first semester, “Computer II” course in second semester, and “Instructional Technology and Material Design” course in fourth semester. Moreover, they attend “School Experience” course in fifth semester and “Practice Teaching I” in seventh semester and “Practice Teaching II” in eighth semester in the Early Childhood Education undergraduate program.

In brief then, convenience sampling method and purposive sampling method were used to form the sample of this study. Moreover, junior and senior preservice early childhood education teachers studying in Ankara was included in the present study.

3.4 The External Validity of the Study

Fraenkel and Wallen (2006) described external validity as “the extent that the results of a study can be generalized from a sample to a population” (p. 108). Since this study used nonrandom sample, this situation can be a threat for generalizability. However, Fraenkel and Wallen (2006) recommend that if it is not feasible and possible to obtain random data, the researcher should describe characteristics of the sample such as age, gender, ethnicity, and socioeconomic status in detail (see Figure 3.1 and Table 3.2). Thus, interested others can make decision from the research findings for themselves.

Moreover, Frankel and Wallen (2006) claim that ecological generalizability is the most powerful way of generalization for nonrandom sampling method rather than random sampling. For this reason, the setting, under which a study conducted, should be explained so that findings of this study can be generalized to the population having similar conditions. To explain, all the implementation procedures were done in ordinary university classrooms and during regular course hours. Moreover, the study was conducted in large universities in Ankara. However, there are several large universities which may have similar opportunities in Turkey. Thus, the findings of present study can be generalized to similar big universities in Turkey.

3.4.1 Sample characteristics.

In order to handle the threat for generalization, sample's demographic information (age, gender, grade, socioeconomic status, high school type) and specific information related to computer technology (computer ownership, Internet access, computer usage time, computer expertise, attending seminars or workshops, technology demands) are demonstrated in detail in the following sections.

3.4.1.1 Demographic information of pre-service early childhood teachers.

Age of preservice early childhood teachers, ranging from 19 to 29, was on an average 21.86. Moreover, as presented in Table 3.2, majority of the participants are female (91%, *n*=391), which is the identical for the profession of early childhood education (MoNE, 2013). Indeed, according to National Education Statistics, 94.2% of early childhood teachers are female in both private and public early childhood education institutions (MoNE, 2013). When socioeconomic status of participants was examined, three variables (family income, mother education level, father education level) contribute to explain the situation. To expound, more than half of the participants' family income is between 1001 and 3000 Turkish Liras in a month (55.4%, *n* = 241). Moreover, almost half of the participants' mother education level of remained as primary school (41.4%, *n* = 180) while father education level of the participants is university degree (36.3%, *n* = 158). Finally, almost half of the participants were graduated from Anatolian Teacher High School type (45.5%, *n* = 198) and it was followed by Anatolian High School type (21.8%, *n* = 95) (see Table 3.3).

Table 3.3

Demographic Information of the Participants

Gender	***f***	**%**
Female	396	91.0
Male	38	8.7
Family Income		
1000 TL and below	53	12.2
1001-3000	241	55.4
3001-5000	96	22.1
above 5000	44	10.1
Mother Education Level		
Primary School	180	41.4
Secondary School	56	12.9
High School	120	27.6
University	68	15.6
Others	11	2.5
Father Education Level		
Primary School	78	17.9
Secondary School	49	11.3
High School	132	30.3
University	158	36.3
Others	18	4.1
High School Type		
Language Intensive High School	15	3.4
General High School	42	9.7
Anatolian High School	95	21.8
Vocational High School	71	16.3
Anatolian Teacher High School	198	45.5
Science High School	4	.9
Others	9	2.1

**Note*. Missing values are not included in the table.

3.4.1.2 Information related to computer technology.

Apart from demographic information of the participants, in the questionnaire the questions related to computer technology was also asked to the respondents.

To begin with, when the participants were asked about computer ownership and internet access at home, almost all of the participants had computers (94%). Moreover, 78.4% of the participants had Internet connection. In terms of computer usage, 34.3% of the preservice early childhood teachers responded that they have used computers for 8 to 10 years while 30.1% of them stated that they have used computers for 5 to 7 years. On the other hand, 19.5% of the preservice early childhood teachers indicated that they have used computers more than 10 years while 15.4 % of them stated that they have used computers for 2 to 4 years. Moreover, the results showed that the least percentages belonged to participants who have used computers less than 1 year (0.7%). Moreover, according to their self-evaluation, they felt themselves as competent (49%) and moderately competent (41.1%) about computer expertise. Finally, most of the participants responded that they did not attend the seminars or workshops related to computer use (84%) (see Table 3.4).

Table 3.4

Computer related Information of the Participants

Computer Ownership	***f***	**%**
Yes	409	94,0
No	26	6,0
Internet Access		
Yes	341	78,4
No	94	21,6
Computer Usage Year		
Less than 1 Year	3	,7
2-4 Years	67	15,4
5-7 Years	131	30,1
8-10 Years	149	34,3
More than 10 Years	85	19,5
Computer Expertise		
Very Competent	1	,2
Competent	28	6,4
Moderately Competent	179	41,1
Incompetent	213	49,0
Very Incompetent	14	3,2
Attending Seminars or Workshops		
Yes	69	15,9
No	366	84,1

**Note.* Missing values are not included in the table.

Moreover, preservice early childhood teachers were asked that which technology you would like to have in your future classrooms to support teaching. The results, in Figure 4.3, showed that the projector (94.5%) and the wireless network access (90%) are the most desired technology by the preservice early childhood teachers. Similarly, majority of the participants stated that they would like to have the amplification system (85.7%), the computer for teacher (79.3%), the ability to videotape (78.9%), and interactive whiteboard (57.5%), respectively. Moreover, they preferred a shared computer for children (44.6%) rather than a computer for each child (25.3%). In addition, while 37.5% of the preservice early childhood teachers requested the tablet PCs for teacher, 14% of them wanted for the children. Finally, the others option (1.4%) was responded as “audiotape” and “camera”.

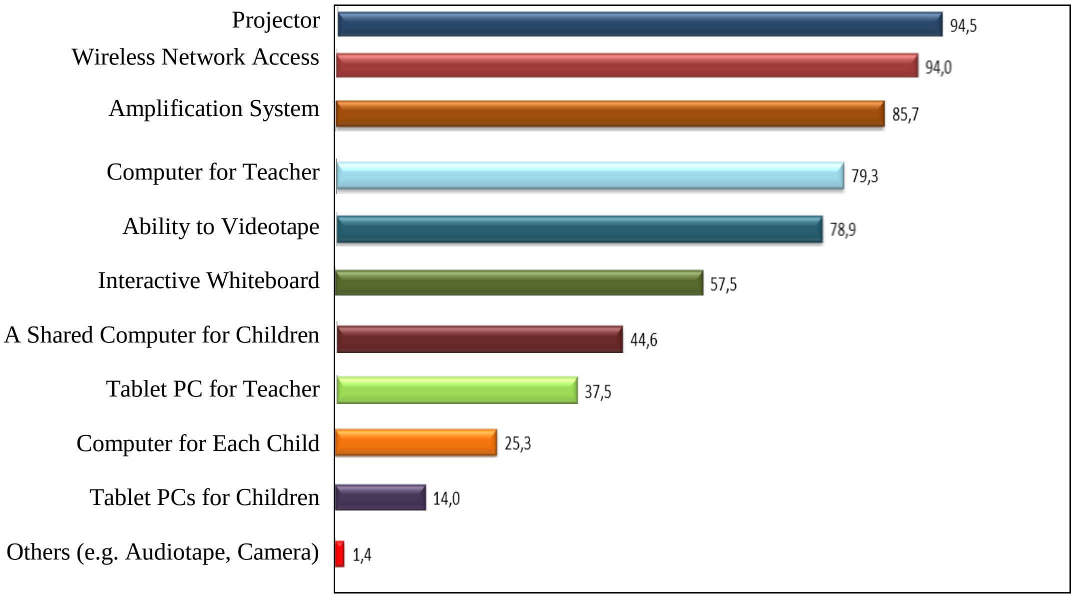


Figure 3.1 Percentages of technology demands for the future classroom settings

3.5 Instrumentation

In this study, three instruments were employed to gather relevant data: Turkish version of Perceived Attributes of Computer Use (PACU) scale, Individual Innovativeness Scale (IIS), and General Information Scale (GIS).

3.5.1. Perceived attributes of computer use (PACU) scale.

The original English scale, the Perceived Characteristics of Innovating, was developed by Moore and Benbasat (1991) and aims to measure the perceptions of adopting of Personal Work Stations (PWS). Although the main purpose of this scale is to measure the diverse perceptions of using Personal Work Stations (PWS) by indivudials, the researchers recommend that this scale can be used by removing the word PWS from the items. Moreover, they stated that making slight modifications, the instrument is appropriate for other diffusion studies. Based on this information, this scale was chosen for three reasons. First, the scale mainly focuses on how potential users' perceptions affect their information technology adoption. Moreover, it can be used for other information technologies. Similarly, the present study intends to sample the potential users' (i.e. preservice teachers) views on adopting computer technology use in early childhood education. Second, the scale focuses on the perception on using the innovations rather than perceptions of innovation itself. Similarly, the present study aims to investigate perceived attributes of computer use rather than computer itself. The last but not least, the scale is recommended by Rogers (2003), the founder of Diffusion of Innovation Theory.

Development of the original instrument was accomplished in three steps. First, item pool was created from existing scales to ensure content validity. The researchers created their own instrument comprising eight components. These components were mainly designed according to Rogers' extensive study (1983) which defines five general attributes of innovations namely relative advantage, compatibility, complexity, trialability, and observability. Beside Rogers' classification (1983), two further constructs, image and voluntariness, were added to the instrument. Second, panels of judge sort were utilized to determine the categories. For this purpose, card sorting method and factor analysis were used. Therefore, construct validity aimed to be ensured. Third, pilot tests and field test were conducted to accomplish final version of the instrument. Finally, the instrument comprising eight components was developed as a long version with 38 items and a short version with 25 items.

Table 3.5

Cronbach Alpha Coefficient of the Original Scale

	Short Version	*Long Version*
Relative Advantage	.90	.92
Compatibility	.86	.83
Ease of Use (Complexity)	.84	.80
Trialability	.71	.71
Result Demonstrability	.79	.77
Visibility	.83	.73
Image	.79	.80
Voluntariness	.82	.87

In order to investigate preservice early childhood teachers' views regarding perceived attributes of computer use, the Turkish version of the Perceived Attributes of Computer Use (PACU) instrument was adapted from the questionnaire "Perceived Characteristics of Innovating" developed by Moore and Benbasat (1991). However, since the study was designed on the basis of Rogers' (2003) theory, only five components were included in the PACU scale. These five components are relative advantage, compatibility, complexity (ease of use in the original scale), trialability, and observability (visibility in the original scale).

3.5.2 Adaptation process of the perceived attributes of computer use (PACU) into Turkish.

Adaptation of the Perceived Attributes of Computer Use (PACU) into Turkish was achieved in three steps namely, translation and adaptation procedure, Q-Sort method, and pilot study. These steps were explained in detail in the following parts.

3.5.2.1 Translation and adaptation procedure of PACU.

The original English scale, Perceived Characteristics of Innovating, was translated and adapted into Turkish. Vijver and Leung (1997) define adaption as "If the construct is not fully covered in the new group, the instrument can be adapted by rephrasing, adding, or replacing items that measure the missing aspects" (p.265). Therefore, in order to cover the target population characteristics and field requirements the researcher needed to make some modifications. Moreover, according to Hambleton (2005), when an instrument is adopted into another language, it is important to include words and expressions which are culturally and psychologically appropriate in the second language rather than to follow simple literal translation procedure. Thus, in translation process, necessary revisions such as were made by changing the name of innovation, the participants, the field, and tense of the sentences to measure domain specific perceptions for the purpose of the study (see Table 3.6).

Table 3.6

Example Changes between the Original and the Adapted Statements

The Original Statement	The Adapted Statement
Using a **PWS** *improves* the quality of work I do.	<u>In early childhood education</u>, **using computer** *will improve* quality of work I do
Using a **PWS** *is* completely compatible with my current **situation**.	<u>In early childhood education</u>, **using computer** *will be* completely *compatible* with my current **experiences.**
I think that using a **PWS** *fits* well with **the way** I like to work.	<u>In early childhood education</u>, **using computer** *will fit* well with **the teaching methods** I like to work.

**Note:* In the table, bold phrase refers to word change, italic phrase refers to tense change, and underlined phrase refers to adding in the sentence.

Moreover, multiple translators are recommended rather than a single translator to avoid particular words or expressions (Hambleton, 2005). Therefore, the scale was firstly translated by the researcher and then sent to seven experts with PhD degree specialized including Computer and Instructional Technology departments and Early Childhood Education department for their expert views. Furthermore, most of the experts studied on different aspects of Rogers' theory as a framework. For instance, one of the experts was the developer of the original English scale who was requested to review the adapted scale. Another expert, Assist. Prof. Dr., examined preservice computer education and instructional technology teachers' individual innovativeness categories and their perceived barriers to innovativeness in his dissertation. The other expert, Assoc. Prof. Dr., explored the implementation process computer assisted language learning by the English teachers. The other expert, Assoc. Prof. Dr., investigated faculties' instructional computer use considering perceived attitudes, adopter categories, support, and the barriers in his dissertation. Another expert with PhD degree explored teachers' views regarding the perceived attributes and the obstacles in the diffusion of informatics technologies in vocational and technical schools in her thesis and published related articles on the topic. As a result, the experts who are interested in similar research subject and proficient in both languages examined the items in detail and made comments on the most appropriate meaning of the field and the sample of the study specifically.

After ensuring the content validity, two instructors, with PhD degree, from the Academic Writing Center consulted for the exact expression of the sentences. Finally, an instructor, with PhD degree, from Turkish Language Department reviewed the last version of the scale items considering the Turkish grammar rules. Thus, adaptation process was accomplished.

In order to ensure construct validity and reliability of the scale, Q-Sort Method and first pilot study were utilized.

3.5.2.2 Q-Sort method and Turkish version of PACU.

Before the pilot study, Q-Sort Method, developed by William Stephenson in 1935, was used to evaluate construct validity and reliability of the questionnaire items (Nahm, Solis-Galvan, Rao & Ragun-Nathan, 2002; Moore & Benbasat, 1991). Q-sort method is unique and special due to the fact that it enables the researcher to collect data both qualitatively and quantitatively (Amin, 2000; Brown, 1996; Valenta & Wigger, 1997). In addition, it is widely used for investigating attitudes (Cross, 2005) in different areas such as education (e.g. Lecouteur & Delfabbro, 2001), communication (e.g. Carlson & Trichtinger, 2001), policy analysis (e.g. Durning, 1999), and information technology (e.g. Moore & Benbasat, 1991).

For this method, each item was printed on index card (see Figure 3.6). Then the cards were numbered and rearranged randomly. Four judge groups were formed as similar as possible to the target participations since sample of this study comprised of junior and senior preservice early childhood education teachers. For example, four participants were junior preservice early childhood teachers, the other two were senior preservice early childhood teachers, and the last group was formed of newly graduates from the Early Childhood Education department. Moreover, age of these volunteer participants was between 21 and 24 years old.

Figure 3.2 The cards used in the Q-Sort method.

At the beginning of the card sorting, the participants were informed about the standards of the process and the tasks. Moreover, the participants were allowed to ask questions in order to prevent any misunderstandings. Therefore, comprehensiveness of the items was aimed to be ensured. There were five labels (relative advantage, compatibility, complexity, trialability, and observability) and thirty-five item cards related to these five labels. As it is seen in Figure 3.6, two sets of cards were designed for the Q-Sort method. The labels (e.g. complexity, trialability) were written in rectangular-shaped cards while the items were written in square-shaped cards (e.g. 5- In early childhood education, using a computer will improve the quality of work I do, 3- I think, in early childhood education, a computer is cumbersome to use).

During the sorting process, the researcher just observed and did not intervene in any way. After the card sets were given to the judges, the judges read the cards and sorted the cards in the most suitable categories according to their thoughts. Moreover, at the any stage of the sorting process, judges were free to make any change of item arrangement. The process took approximately twenty minutes and at the end of the sorting, the item number and the related labels were noted by the researcher.

Then, the judge groups were allowed to compare and discuss their individual sorting results. This part of the process provides deep understandings about participants' thoughts underlying behind the sorting procedures. They explained the reasons for the categorization of the items. According to their comments and responses, the items were reorganized in terms of word order. For example, most of the participants said that the word which is close to the main verb played an important role in order to decide on the place of the items. Therefore, the place of the word which is determinative for the construction of the item was written next to the main verb so that the items become clear enough for the participants.

3.5.2.2.1 Analysis of Q-Sorting.

Two different measurements are used to assess reliability of Q-Sorting Method: Level of agreement (Cohen's Kappa) and Inter-Judge Agreement (Hit Ratio of Placement) (Nahm et. all, 2002). To begin with, "Cohen's Kappa as a measure of aggrement can be interpreted as the proportion of joint judgement in which there is agreement after chance agreement excluded" (Nahm et. all, 2002, p.3). Although there is not a general agreement for required scores, some research shows that the acceptable score is grater than 0.65 (e.g. Jarvenpaa, 1989; Moore & Benbasat, 1991; Vessey, 1984). In this study, Cohen's Kappa was found 0.82, greater than 0.65, at the end of the fourth round. Therefore, it can be stated that the measure of agreement was assured. Second, Inter-Judge Agreement was examined. Nahm et al. (2002) defines that "The item placement ratio (the Hit Ratio) is an indicator of how many items were placed in the intended or target category by the judges"(p.4). That is, the degree of inter-judgement agreement across the panel depends on the degree of the percentages of the items placed in the target construct. Although maximum value corresponds to "1", the higher percentage means the higher degree of inter-judge agreement. Therefore, there is not any rule for defining good degree of placement (Moore & Benbasat, 1991). In this study, Relative Advantage (1.00), Compatibility (1.00), and Complexity (1.00) showed a "very good" degree of placement while Trialability (0.71) and Observability (0.71) showed a "good" inter-judgement agreement at the end of the fourth round. Moreover, overall placement ratio was measured as 0.88 which can be considered as a "very good" degree of placement (see Table 3.7).

Table 3.7

The Measurements to Assess Reliability of Q- Sorting Method

Agreement Measure	Round 1	Round 2	Round 3	Round 4
Raw Agreement (%)	0.76	0.86	0.77	0.97
Cohen's Kappa	0.58	0.68	0.60	0.82
Placement Ratio Summary (%)				
Relative Advantage	0.88	0.88	1.00	1.00
Compatibility	0.75	1.00	0.75	1.00
Complexity	0.50	0.33	0.67	1.00
Trialability	0.71	0.29	0.71	0.71
Observability	0.50	0.60	0.60	0.70
Average (%)	0.67	0.62	0.75	0.88

As a result, at the end of the Q-Sort, the original length of the scale with 35 items was reduced in 26 items (see Table 3.8).

Table 3.8

The Changes on Item Numbers after Q-Sort Method

Scale	**Original Length**	**Reduced Length**
Relative Advantage	8	7
Compatibility	4	4
Complexity	6	5
Trialability	7	5
Observability	10	5
TOTAL	35	26

3.5.2.3 Pilot study and factor analysis.

After Q-Sort method, the pilot study of Turkish version of PACU was conducted to 137 preservice early childhood teachers at a state university in Ankara. Participants of this study were comprised of 128 female (93.4%) and 9 male (6.6%) with a mean age of 21.74 years (*SD* = 1.55). Of the sample, 40.1% of the participants' father education level was university degree while 35.8% of the participants' mother education level was primary school degree as representing the majority group in relation to degree of education. Moreover, more than half of the participants' family income was between 1001 and 3000 Turkish Liras in a month (59.1%, *n* = 81). Finally, the high school that participants graduated from was mostly Anatolian Teacher High School (75.2%, *n* = 103) (see Table 3.9).

Table 3.9

Demographic Information of the Participants in Pilot Study

Gender	***f***	**%**
Female	128	93.4
Male	9	6.6
Family Income		
1000 TL and below	18	13.1
1001-3000	81	59.1
3001-5000	31	22.6
above 5000	6	4.4
Mother Education Level		
Primary School	49	35.8
Secondary School	17	12.4
High School	39	28.5
University	27	19.7
Others	5	3.6
Father Education Level		
Primary School	30	21.9
Secondary School	16	11.7
High School	34	24.8
University	55	40.1
Others	2	1.5
High School Type		
Language Intensive High School	-	-
General High School	-	-
Anatolian High School	8	5.8
Vocational High School	24	17.5
Anatolian Teacher High School	103	75.2
Science High School	1	.7
Others	-	-

Besides the demographic information, the participants of the pilot study were described by computer related information. To expound, majority of the participants had computer (98.5%, *n* = 135) and the Internet access (94.9%, *n* = 130) at home.

Furthermore, the participants have used computer for 8 to 10 years (34.3%, *n* = 47), which represented the majority group in terms of computer usage year. Furthermore, more than half of them felt themselves as competent (55.5%, *n* = 76). Finally, vast majority of the participants responded that they did not attend the seminars or workshops related to computer use (91.2%, *n* = 125) (see Table 3.10).

Table 3.10

Computer related Information of Participants in Pilot Study

Computer Ownership	***f***	**%**
Yes	135	98.5
No	2	1.5
Internet Access		
Yes	130	94.9
No	7	5.1
Computer Usage Year		
Less than 1 Year	1	.7
2-4 Years	15	10.9
5-7 Years	34	24.8
8-10 Years	47	34.3
More than 10 Years	40	29.2
Computer Expertise		
Very Competent	8	5.8
Competent	76	55.5
Moderately Competent	43	31.4
Incompetent	9	6.6
Very Incompetent	1	.7
Attending Seminars or Workshops		
Yes	12	8.8
No	125	91.2

In brief then, characteristics of the participants were almost same both in the pilot and main study, which provided to maintain the study controlling subject characteristics differences.

As presented in Table 3.11, the first version of PACU including 26 items as seven items (item 1, 2, 3, 4, 5, 6, 7) of relative advantage, four items (item 8, 9, 10, 11) of compatibility, five items (item 12, 13, 14, 15, 16) of complexity, five items (item 17, 18, 19, 20, 21) of trialability, and five items (item 22, 23, 24, 25, 26) of observability.

Table 3.11

Distribution of the Turkish version of PACU Items in the Pilot Study

Components	**Number of Items**	**Item Numbers**
Relative Advantage	7	Item 1 to 7
Compatibility	4	Item 8 to 11
Complexity	5	Item 12 to 16
Trialability	5	Item 17 to 21
Observability	5	Item 22 to 26
Total	26	

3.5.2.4 Exploratory factor analysis.

In order to display construct of Turkish version of PACU scale, exploratory factor analysis was conducted. For this purpose, depending on whether the factors related to each other, rotation method was decided. Tabachnick and Fiddell (2007) recommend that “Perhaps the best way to decide between orthogonal and oblique rotation is to request oblique rotation with the desired number of factors and look at the correlations among factors…If correlations exceed .32, then there is 10% (or more) overlap in variance among factors, enough variance to warrant oblique rotation unless there are compelling reasons for orthogonal rotation.” (p. 646). Thus, based on this recommendation, the oblique rotation was requested and the component correlation matrix was examined. As it is seen in Table 3.12, the correlation between three factors was above .32. For example, it was .35 between factor1 and factor2, .41 between factor1 and factor4, and .42 between factor1 and factor5.

Table 3.12

Correlations between the Factors of Turkish version of PACU

Factor	1	2	3	4	5
1	1.000	**.350**	.161	**.411**	**-.428**
2	**.350**	1.000	.262	.298	-.096
3	.161	.262	1.000	.013	-.058
4	**.411**	.298	.013	1.000	-.067
5	**-.428**	-.096	-.058	-.067	1.000

Therefore, oblique rotation was chosen for this study. Indeed, oblique rotation method is considered that it gives more accurate and more reproducible solution in social sciences. In addition, maximum likelihood estimation was preferred since it helps to explain discrimination between shared and unique variance compared to principal components analysis (Costello & Osborne, 2005). As a result, maximum likelihood extraction technique method and oblique rotation method (direct oblimin) were used for the present study.

After deciding rotation method, two main issues were ensured to examine factor analysis results. These are sample size and the strength of relationships among the items (Pallant, 2007).

Firstly, sample size was checked. Although there is not a general agreement on this issue, there are some suggestions for the suitable sample size. For example, according to Gorsuch (1983), sample size should be at least 100, and the ratio of subjects to item should be minimum 5. For another example, Cattell (1978) suggests that this ratio should be in the range of 3 to 6. Therefore, since there are 26 items and 137 participants in the study, the sample size assumption was assured.

Secondly, the strength of relationships among the items was checked and two statistical measures namely Bartlett's test of sphericity and the Kaiser-Meyer-Olkin measure of sampling adequacy (KMO) were examined. According Tabachnick and

Fidell (2007), the strength of relationships should be greater than .3 at least in some correlations, Bartlett's test of sphericity value should be significant at $p < .05$ and the Kaiser-Meyer-Olkin measure of sampling adequacy (KMO) value should be .06 or above. In this study, all of these values were sufficient since Bartlett's test of Sphericity ($\chi 2$=2026, 325 and p=.000), KMO measure was found to be .847 and correlation coefficients were greater than 0.3 among majority of the pairs of items. As a result, for this study, all issues were ensured to perform.

After ensuring the required assumptions, factor analysis was conducted to 26 items. For the components, eigenvalues should be greater than 1 (Kaiser, 1960). Moreover, Pallant (2007) explains that it could be better to interpret the scree plot, if many components were formed based on the Kaiser criterion. Thus, when the scree plot was examined, five factors was seen more proper (Field, 2005) (see Figure 3.3).

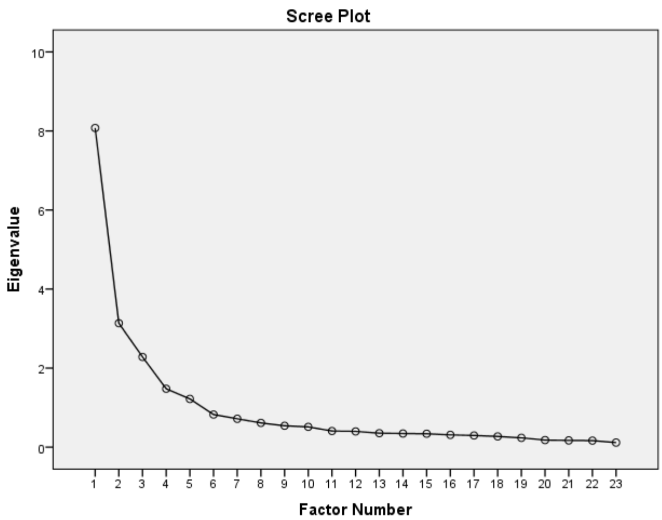


Figure 3.3 Scree plot for the pilot study.

The results of the explanatory factor analysis showed that except from four items, all of the items clearly loaded in the related five components. To explain, two items Q14 (In early childhood education, using a computer will fit into my work style) and Q12 (In early childhood education, I am permitted to use a computer on a trial basis long enough to see what it could do" loaded in a different factor. Moreover, the other two items Q13 (In early childhood education, using a computer will improve my job performance) and Q26 (I have not seen many others using a computer in early childhood education) did not load in any factor. Therefore, considering content of the all items, three items (Q12, Q14, Q26) were removed from the scale and one item (Q13) was kept without any change in the scale.

After these changes, as a result, the scale including five factors with 23 items was designed. Table 3.13 illustrates last version of the items and factor loadings for the factors.

Table 3.13

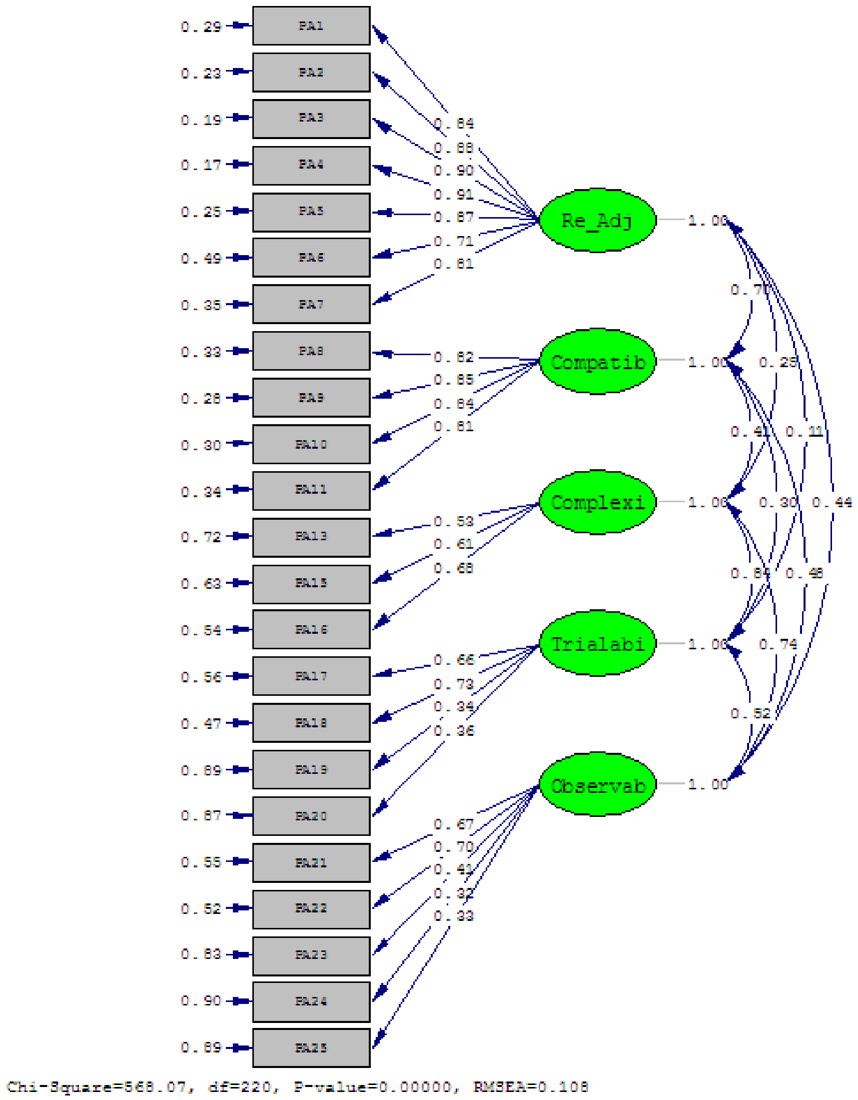
Turkish version of Perceived Attributes of Computer Use (PACU) Item Factor Loadings

Item	Relative Advantage	Observability	Trialability	Compatibility	Complexity
			Factor Loadings		
Q1	**.828**	.052	-.056	.032	-.068
Q2	**.935**	-.016	-.008	.098	-.047
Q3	**.923**	.026	-.031	.018	.012
Q4	**.909**	.006	.057	-.019	.035
Q5	**.806**	.003	.091	-.113	.057
Q6	**.524**	.041	-.030	-.298	.054
Q7	**.735**	-.004	-.019	-.080	-.050
Q8	-.061	.009	.027	**-.890**	.046
Q9	.059	.048	.053	**-.780**	-.003
Q10	.060	-.006	-.043	**-.790**	-.042
Q11	.123	-.011	-.025	**-.658**	-.176
Q12 (R)	.083	-.012	-.030	-.047	**-.637**
Q13 (R)	-.077	-.003	.048	.023	**-.851**
Q14	.018	.074	.030	-.025	**-.669**
Q15 (R)	.060	-.006	**.690**	.086	-.007
Q16	.056	-.083	**.471**	-.049	-.183
Q17	.011	-.037	**.852**	-.032	.055
Q18	-.077	.135	**.555**	-.077	.002
Q19	-.045	.011	**.700**	.011	-.008
Q20	.046	**.703**	.092	.022	.046
Q21 (R)	-.003	**.900**	-.090	.045	-.047
Q22 (R)	-.023	**.916**	-.087	-.019	-.019
Q23	.039	**.437**	.106	-.078	-.037

**Note.* The highest factor loadings are presented in bold. Extraction method: Maximum Likelihood. Rotation method: Oblimin with Kaiser Normalization.

3.5.2.5 Confirmatory factor analysis.

After the pilot study, explanatory factor analysis was established five factors for the scale Turkish version of PACU. In order to confirm these factors, confirmatory factor analysis was conducted to using LISREL 8.8 statistical program (Jöreskog & Sörbom, 2006). It was hypothesized that the observed variables PA1, PA2, PA3, PA4, PA5, PA6, PA7 loaded on the latent variable “relative advantage”, the observed variables PA8, PA9, PA10, PA11 loaded on the latent variable “compatibility”, the observed variables PA13, PA15, PA16 loaded on the latent variable “complexity”, the observed variables PA17, PA18, PA19, PA20 loaded on the latent variable “trialability”, and the observed variables PA21, PA22, PA23, PA24, PA25 loaded on the latent variable “observability”. This hypothesized model for the Turkish version of PACU was displayed in Figure 3.4.



Note. Re_Adj = relative advantage; Compatib = compatibility; Complexi = complexity; Trialabi = trialability; Observab = Observability.

Figure 3.4. Hypothesized model for the 23-Item Turkish version of PACU scale.

The LISREL output presented various goodness of fit statistics that could be used evaluating of the fit between the hypothesized model and the data set. Brown (2006) grouped these fit indices into three categories, namely "absolute fit, fit adjusting for model parsimony, and comparative or incremental fit" (p.82). To explain, the absolute fit consists of chi-square (χ^2), the standardized root mean square residual (SRMR), and the root mean square residual (RMR) indexes. For the fit adjusting for model parsimony, which is sometimes included in absolute fit group, root mean square error of approximation (RMSEA; Steiger & Lind, 1980) is widely used. For RMSEA, the value lower than .05 refers a close fit, the value .08 implies a marginal fit and the value greater than .10 indicate poor fit (Browne & Cudeck, 1993). The comparative or incremental fit indexes is considered more affirmative than indicies of the other categories since it assess the model fit with a solution supporting relationships among the variables. The most common indexes used for this group is comparative fit index (CFI) (Bentler, 1990; Jöreskog & Sörbom, 1981) and non-normed fit Index (NNFI) (Brown, 2006). The possible value for CFI and NNFI is between 0 to 1 while the values closer to 1 refers to better fit (Brown, 2006). Morevover, incremental fit index (IFI) and the normed fit index (NFI) could be used to represent the comparative fit indices (Hu & Bentler, 1995). Since each of these groups gives different information about model fit, it is recommended to include at least one index from each category (Brown, 2006). Therefore, in order to interpret the results of confirmatory factor analysis, the chi-square, RMSEA, CFI, and NNFI values were evaluated considering the recommendations and cutoff criteria.

As it was presented in Table 3.14, multiple goodness-of-fit tests were used to evaluate the fit between the hypothesized Turkish version of PACU instrument and the data set. The NNFI (.92) and CFI (.93) values showed a good fit values as being greater than .90 (Kline, 1998). The RMSEA (.97) value could be considered as a mediocre fit since it was between .80 and .10. The value of χ^2/df (2.58) indicated a good fit since it was less than 5 (Kelloway, 1998). As a result, when the overall indices were considered, it could be concluded that five-factor Turkish version of PACU scale has a good fit.

Table 3.14

Goodness-of-Fit Indicators of the Models for the Turkish version of PACU Scale

Model	df	χ^2	χ^2/df	NNFI	CFI	RMSEA
Five Factor	220	568.07*	2.58	0.92	0.93	0.97(with a 90% confidence interval)

Note. NNFI = non-normed fit index; CFI = comparative fit index; RMSEA = root mean square error of approximation.
*p < .001.

3.5.2.6 Reliability analysis of the Turkish version of PACU.

In order to establish reliability of Turkish version of PACU, Cronbach's coefficient alpha was computed for each factor of the Turkish version of PACU. According to DeVellis (2003), the Cronbach alpha coefficient value should be greater than .70. In this study, the Cronbach alpha coefficient was calculated and found as .96 for relative advantage, .89 for compatibility, .79 for complexity .77 for trialability, and .87 for observability dimension. Moreover, for the whole scale, the reliability of efficacy scores was .90 (see Table 3.15). Therefore, it can be concluded that the instrument of this study has a good reliability.

Table 3.15

Cronbach Alpha Coefficient of Turkish version of PACU Scale

Scale	**Turkish Version**	**Original English Version**	
		Short Scale	*Long Scale*
Relative Advantage	.96	.90	.92
Compatibility	.89	.86	.83
Complexity	.79	.84	.80
Trialability	.77	.71	.71
Observability	.87	.83	.73
Whole Scale	.90		

As a result, the measures and the evidences show that the instrument Turkish version of PACU is both valid and reliable. Therefore, the scale Turkish version of PACU was utilized to examine preservice early childhood teachers' views regarding the perceived attributes of computer use. Moreover, items of the Turkish version of

PACU were scored on the scale where 1 corresponded to “strongly disagree” response and 5 corresponded to “strongly agree” response.

3.5.3 Individual innovativeness scale (IIS).

In order to investigate preservice early childhood teachers’ level of individual innovativeness, Turkish version of Individual Innovativeness Scale (IIS) was used. The original English scale including 20 items was developed by Hurt, Joseph, and Cook (1977). The internal consistency coefficient of the scale was found as 0.89 (Hurt et al., 1977) and the scale is considered as one of the four best instruments measuring the innovativeness in the literature (Goldsmith and Foxall, 2003).

Turkish version of this scale was developed by Kılıçer and Odabaşı (2010) and was utilized for 781 preservice teachers in computer education and instructional technology department. The adapted scale was consisted of four sub-scales namely, willing to try, opinion leader, resistance to change, risk-taking. The reliability coefficient was calculated for the each dimension of the scale as well as for the whole scale. To explain, the Cronbach alpha value was found as 0.81 for the “resistance to change”, 0.73 for the “opinion leader”, 0.77 for the willing to try, and 0.62 for the risk-taking. Moreover, the Cronbach alpha value of whole scale was found as 0.82 which is greater than cut-off value .70 (DeVellis, 2003). Therefore, the adopted scale is considered to have a good reliability. Moreover, the reliability coefficient value shows a similarity with the other studies that used the Individual Innovativeness Scale (e.g. Brahier, 2006; Pallister & Foxall, 1998; Simonson, 2000).

The Turkish version of the scale includes twenty items which reflect five different adopter categories as defined in Rogers’ theory (2003). In the scale, twelve items (1, 2, 3, 5, 8, 9, 11, 12, 14, 16, 18, and 19) are related to positive expressions and the other eight (4, 6, 7, 10, 13, 15, 17, and 20) are related to negative expressions. For example, “I seek out new ways to do things” is one of the item related to positive expressions while “I am generally cautious about accepting new ideas” is related to negative expression. According to Hurt et al. (1977), calculation of the total innovativeness score was computed by subtracting the scores of the negative items from the score of the positive items, and adding 42 points to this score. In other words, the formula “42 + sum of the positive items score – sum of negative items score” was used to calculate innovativeness score of the participants (Hurt et al., 1977). Hence, the scores obtained from the formula could be used to determine the innovativeness level of individuals. For example, the individuals who have the score above 68 are considered high in innovativeness while below 64 are considered low in innovativeness (Hurt et al., 1977).

On the other hand, in order to determine adopter categories, the individuals were categorized by the range of their innovativeness score. For example, the individuals having the individual innovativeness scores greater than 80 are grouped in Innovators while the individuals having the individual innovativeness score smaller than 46 are grouped in Laggards. Moreover, the participants having the score between 69 and 80 are grouped in Early Adopters, those whose scores are between 57 and 68 are grouped in Early Majority, and those having the score between 46 and 56 are grouped in Late Majority group (Hurt et al., 1977) (see Table 3.16).

Table 3.16

Determinant of the Adopter Categories based on Innovativeness Score

Innovativeness Scores	**Adopter Categories**
Greater than 80	Innovator
Between 69 and 80	Early Adopter
Between 57 and 68	Early Majority
Between 46 and 56	Late Majority
Smaller than 46	Laggard

3.5.4 General information scale (GIS).

In order to investigate demographic information of preservice early childhood teachers, their communication channel preferences, and their technology preferences, General Information Scale (GIS) was developed by the researcher. For the development of this scale, previous studies and Rogers' theory (2003) were inspired. Thus, fourteen questions were included in the scale to gather the information mentioned previously. As presented in Table 3.17, the scale GIS comprised of 14 items as four items (item 1, 2, 3, 7) of demographic information, three items (item 4, 5, 6) of socioeconomic status, five items (item 8, 9, 10, 11, 12) of computer use, one item (item 13) of technology demands, and one item (item 14) of preferences.

Table 3.17

Content of the General Information Scale (GIS)

Question Type	**Item No**	**Variables**
Demographic Information	1, 2, 3, 7	Gender, Age, Grade, High school type
Socioeconomic Status	4, 5, 6	Family income, mother education level, father education level
Computer use	8, 9, 10, 11, 12	Computer ownership, Internet access, attending computer related course or seminar, computer usage year, computer expertise
Technology demands	13	Technology demands (for future teaching environment)
Preferences	14	Communication Channel preferences (to get new information about computer use)

3.6 Data Collection Process

In order to gather data, some formal procedures were followed for implementation of the instruments. First, ethical permission was taken from the Research Center for Applied Ethics ethical committee at Middle East Technical University. Second, other universities were officially informed via METU and required permissions were taken from other four universities. Third, course instructors were met and time schedule was formed according to departments' course schedules. Finally, the data collection period started in March, 2013 and finished in May, 2013.

After taking all official permissions and arranging the date, the researcher went to the each classroom and applied the paper-based instruments herself. Before implementing the survey, all participants have been informed about the aim of the study, the content of the survey, and method of responding the items. Moreover, participants were told that there was no right or wrong response in the survey and their opinions were important. Furthermore, in order to keep the confidentiality of the data, the participants were informed that any of the data will not be shared with third person and the data gathered will be used only for scientific research studies. Finally, the participants were told that they could quit the survey any time.

As a result, all volunteer participants, in total 436, filled in the questionnaires (Turkish version of PACU, IIS, and GIS) at the beginning of their courses and it took approximately 15-20 minutes. Moreover, during the implementation, the researcher stayed in the class to answer the further questions about survey.

3.7 The Internal Validity of the Study

Fraenkel and Wallen (2006) defined the internal validity as "…observed differences on the dependent variable are directly related to the independent variable and not due to some other unintended variable" (p. 169). Therefore, there can be some threats such as subject characteristics, loss of subjects (or mortality), location, instrumentation, testing, history, maturation, attitude of subjects, regression, and implementation to a study's internal validity (Fraenkel & Wallen, 2006). On the other hand, Fraenkel and Wallen (2006) recommend four techniques to control effects of these threats namely standardizing the conditions, obtaining and using more information on the subjects, obtaining and using more information on details, and choosing appropriate design. For this study, the threats which are subject characteristics, loss of subjects (or mortality), location, and instrumentation and the suitable controlling techniques were addressed in the following paragraphs in details.

To begin with a threat, subject characteristics is one of them. According to Fraenkel and Wallen (2006), subject characteristics means “the selection of people for a study may result in the individuals (or groups) differing from one another in unintended ways that are related to the variables to be studied” (p.170). For this study, some factors such as age, gender, and courses taken in university can be considered as unintended variables related to subject characteristics. However, using the technique “obtaining and using more information on the subjects” these variables aimed to be controlled. For this aim, the researcher examined the each university’s course catalog and ensured that all participants have attended the courses related to computer use and school experience. Indeed, one of the main reason to choose only third-year and fourth-year students is to prevent this threat. Moreover, it was obtained that majority of the preservice early childhood teachers are female in each case and the age range of participants are close to each other. Thus, the subject characteristics could not be a threat for this study.

The other threat is loss of subjects (or mortality). According to Fraenkel and Wallen (2006), mortality occurs when participants are absent during the data collection or fail to complete the questionnaires for a reason. Although this threat is the most difficult to completely prevent, the researcher aimed to control it using the technique “obtaining and using more information on the subjects”. For this aim, academic calendars of the universities were examined to determine national holidays and exam terms. Outside of these dates, with the suggestions of instructors, the data were collected at the time when the participation of the students is as much as possible. On the other hand, in order to increase the completion of the survey, purpose of the study was clearly explained and the importance of completely filling the questionnaires was specifically emphasized beforehand. At the end, except for two people, almost all of the participants filled in the questionnaire entirely. Incomplete cases were removed from the data of the study. As a result, the mortality threat could be controlled for the study.

Another threat is location. According to Fraenkel and Wallen (2006), location refers to place where the data are collected. That is, physical characteristics (size, lighting, noise) of classroom or the equipment used may affect data collection process. However, all of the instruments were conducted in regular classroom environments in which conditions are same in each education department. Therefore, the location did not become a threat for this study.

The other threat is instrumentation. According to Fraenkel and Wallen (2006), instrumentation threat consists of instrument decay, data collector characteristics and data collector bias. However, using “standardizing the conditions” technique, these variables aimed to be controlled. Since the study is designed as survey research, the responds of participants were collected using questionnaires. Therefore, scoring of the instrument and coding of the variables were standard for all of the cases. Moreover, since the data were collected by the researcher in all implementations, the characteristics of the data collector did not become a threat. Furthermore, the researcher did not lead the participants around to her point of view or hypothesis of the study in any way. Thus, the instrumentation could not be a threat for this study.

3.8 Ethical Issues

Fraenkel and Wallen (2006) state that researchers should be aware of three ethical principles which are (1) to protect participants from harm, (2) to ensure confidentiality of data, and (3) to prevent deception of the participants.

The present study did not cause any physical or psychological harm for the participants. Moreover, participants were declared that it is not mandatory to attend the survey. Furthermore, the participants were informed that they could leave the questionnaire at any time they want.

In addition, the participants were not requested to provide any personal information regarding their identity while responding the scale items. Instead, only numbers were randomly assigned to subjects participated in the study in order to set the confidentiality of the data.

Lastly, required explanations were also read to subjects in each class that study was conducted. Therefore, it could be said that the deception of the participants was not a question in the present study.

In brief then, as explained above, all ethical issues were ensured for this study.

3.9. Data Analysis Procedure

Before start to analyze, the data set were checked for errors. First, the variables were checked for scores whether they are within the range of possible scores or not. Second, the data which have error were corrected (Pallant, 2007). Therefore, all of the variables of the study were checked and only family income variable was found that it has two cases with value 5 instead of value 4. This error was corrected and the data prepared to be analyzed. Moreover, the distribution of scores on the dependent variable was checked for normality and outliers. Since a case (363) caused a difference between the original mean of Innovativeness score (65.01) and the trimmed mean (64.89), the case was removed the data. On the other hand, histogram, and plots showed that the distribution of scores on the dependent variable is ‘normal’.

For the present study, data were gathered by Turkish version of Perceived Attributes of Computer Use (PACU), Individual Innovativeness Scale (IIS), and General Information (GI) scale. Since all of the scale was designed to obtain quantitative data, data were analyzed with the help of the statistical analysis software program PASW Statistics 20 by conducting two analysis methods namely; descriptive statistical techniques and MANOVA (see Table 3.18).

Table 3.18
Summary of the Research Methodology

Research questions	Research Type	Research Methodology	Analysis Method
RQ1, RQ2, RQ4	Descriptive Study	Survey Research	Descriptive statistical techniques
RQ3	Associational Study	Causal-Comparative Research	MANOVA

To explain, descriptive statistical techniques were used to answer the first research question "What are the preservice early childhood teachers' perceived attributes regarding the instructional computer use?", the second research question "What are the preservice early childhood teachers' innovativeness levels and their adopter categories?", and the fourth research question "What are the preservice early childhood teachers' communication channel preferences to learn about computer use?".

MANOVA was used for the analysis of the third research question "Is there a significant difference between the preservice early childhood teachers' adopter categories regarding the perceived attributes of instructional computer use?".

CHAPTER 4

RESULTS

In this chapter, the findings of this study will be presented in detail. As explained beforehand, two analysis methods were conducted to answer the research questions of the study namely, descriptive statistical techniques and MANOVA to answer four research questions. Moreover, preliminary analyses were done to ensure the required assumptions for MANOVA.

4.1 Research Question 1: What are the preservice early childhood teachers' perceived attributes regarding the instructional computer use?

In order to answer this question, the data, collected by Turkish version of PACU scale, were analyzed by descriptive statistics. For this purpose, each component of the scale, namely, relative advantage, compatibility, complexity, trialability, and observability, was displayed by the corresponded items. Then, the results were interpreted for the each part of the scale.

To begin with relative advantage, majority of the preservice early childhood teachers agreed that using computers in early childhood education will provide benefits to them (see Table 4.1). Second, in terms of compatibility of computer use in early childhood education, preservice early childhood teachers have both neutral and positive view considering their current situations (see Table 4.2). Third, regarding complexity of computer use in early childhood education, most of the preservice early childhood teachers perceived that computer use will not be difficult in early childhood education (see Table 4.3). Fourth, most of the preservice early childhood teachers responded that they had neutral view trialability of computer use in early childhood education (see Table 4.4). That is, they perceived that they did not have enough opportunity to try computer applications prepared for early childhood education Fifth, majority of the preservice early childhood teachers agreed that they could observe computer use in early childhood education (see Table 4.5).

Table 4.1

Descriptive Statistics for Relative Advantage Items

		Strongly Disagree		Disagree		Neutral		Agree		Strongly Agree	
In early childhood education,	***M***	***f***	**%**	***f***	**%**	***f***	**%**	***f***	**%**	***f***	**%**
1. using a computer will make it easier to do my job.	4.13	8	1.8	19	4.4	38	8.7	215	49.4	155	35.6
2. using a computer will increase my productivity.	4.10	4	.9	23	5.3	41	9.4	225	51.7	141	32.4
3. using a computer will enhance my effectiveness on the job.	4.08	6	1.4	22	5.1	48	11.0	212	48.7	146	33.6
4. using a computer will improve my job performance.	4.06	5	1.1	22	5.1	54	12.4	215	49.4	139	32.0
5. using a computer will improve the quality of work I do.	4.04	5	1.1	24	5.5	66	15.2	195	44.8	145	33.3
6. using a computer will give me greater control over my work.	3.88	6	1.4	20	4.6	104	23.9	193	44.4	111	25.5
7. using a computer will be advantageous in my job, overall.	4.07	6	1.4	12	2.8	29	6.7	229	52.6	159	36.6

Table 4.2

Descriptive Statistics for Compatibility Items

		Strongly Disagree		Disagree		Neutral		Agree		Strongly Agree	
In early childhood education,	***M***	***f***	**%**	***f***	**%**	***f***	**%**	***f***	**%**	***f***	**%**
8. using a computer is compatible with all aspects of my work.	3.29	12	2.8	76	17.5	166	38.2	135	31.0	45	10.3
9. using a computer is completely compatible with my current experiences.	3. 36	12	2.8	67	15.4	158	36.3	146	33.6	50	11.5
10. I think using a computer will fit well with the teaching methods I like to work.	3.52	10	2.3	52	12.0	132	30.3	182	41.8	59	13.6
11. using a computer will fit into my work style.	3.69	9	2.1	34	7.8	114	26.2	203	46.7	75	17.2

Table 4.3

Descriptive Statistics for Complexity Items

		Strongly Disagree		Disagree		Neutral		Agree		Strongly Agree	
	M	***f***	**%**	***f***	**%**	***f***	**%**	***f***	**%**	***f***	**%**
12. In early childhood education, using a computer is often frustrating.	2.02	115	26.4	234	53.8	52	12.0	25	5.7	7	1.6
13. In early childhood education, a computer is cumbersome to use.	2.04	131	30.1	199	45.7	63	14.5	38	8.7	3	.7
14. Overall, I believe that a computer is easy to use in early childhood education.	3.85	8	1.8	41	9.4	54	12.4	234	53.8	94	21.6

Table 4.4

Descriptive Statistics for Trialability Items

		Strongly Disagree		Disagree		Neutral		Agree		Strongly Agree	
In early childhood education,	***M***	***f***	***%***	***f***	***%***	***f***	***%***	***f***	***%***	***f***	***%***
15. I do not really have adequate opportunities to try out different things on the computer.	2.76	62	14.3	132	30.3	111	25.5	104	23.9	24	5.5
16. I can have computer applications for long enough periods	3.44	14	3.2	50	11.5	136	31.3	198	45.5	36	8.3
17. I have had a great deal of opportunity to try various computer applications.	2.77	33	7.6	153	35.2	143	32.9	90	20.7	15	3.4
18. I have permitted to use a computer on a trial basis long enough to see what it could do.	3.22	29	6.7	79	18.2	126	29.0	165	37.9	33	7.6
19. before deciding whether to use any computer applications, I was able to properly to try them out.	3.06	26	6.0	103	23.7	148	34.0	134	30.8	23	5.3

Table 4.5

Descriptive Statistics for Observability Items

		Strongly Disagree		Disagree		Neutral		Agree		Strongly Agree	
In early childhood education,	***M***	***f***	**%**	***f***	**%**	***f***	**%**	***f***	**%**	***f***	**%**
20. I have had plenty of opportunity to see the computer being used.	3.66	17	3.9	72	16.6	61	14.0	172	39.5	108	24.8
21. I have not seen many others using a computer.	2.34	126	29.0	158	36.3	46	10.6	86	19.8	18	4.1
22. using a computer is not very visible.	2.42	124	28.5	139	32.0	56	12.9	94	21.6	21	4.8
23. I have seen what others do using their computers.	3.61	9	2.1	51	11.7	104	23.9	207	47.6	63	14.5

As a result, the preservice early childhood teachers perceive that computer use for instructional purposes (1) provides advantages, (2) is not complex, and (3) can be observed in early childhood settings. Moreover, they have both neutral and positive perception for the compatibility of the computer use for instructional purposes. However, they have a clear neutral perception for the trialability of computers for instructional purposes (see Table 4.6).

Table 4.6

Descriptive Statistics for Turkish version of PACU Sub-Scales

Name of the Sub-Scale	***M***	***SD***	**Min**	**Max**	**N**
Relative advantage	4.07	0.75	1	5	433
Compatibility	3.47	0.83	1	5	433
Complexity	3.94	0.44	1	5	428
Trialability	3.15	0.75	1	5	434
Observability	3.63	0.94	1	5	433

4.2 Research Question 2: What are the preservice early childhood teachers' innovativeness levels and their adopter categories?

In order to investigate this research question, firstly, individual innovativeness score was calculated for each participant and innovativeness profile of the preservice early childhood teachers was displayed. To begin with, preservice early childhood teachers' average innovativeness score is 65.12 (*SD* = 7.8, *N* = 433).

Moreover, according to Hurt, Joseph, and Cook (1977), individuals who score above 68 are considered high in innovativeness while below 64 are considered low in innovativeness. Therefore, in the present study, 43% of the preservice early childhood teachers can be considered highly innovative while 57% of them lowly innovative (see Figure 4.1).

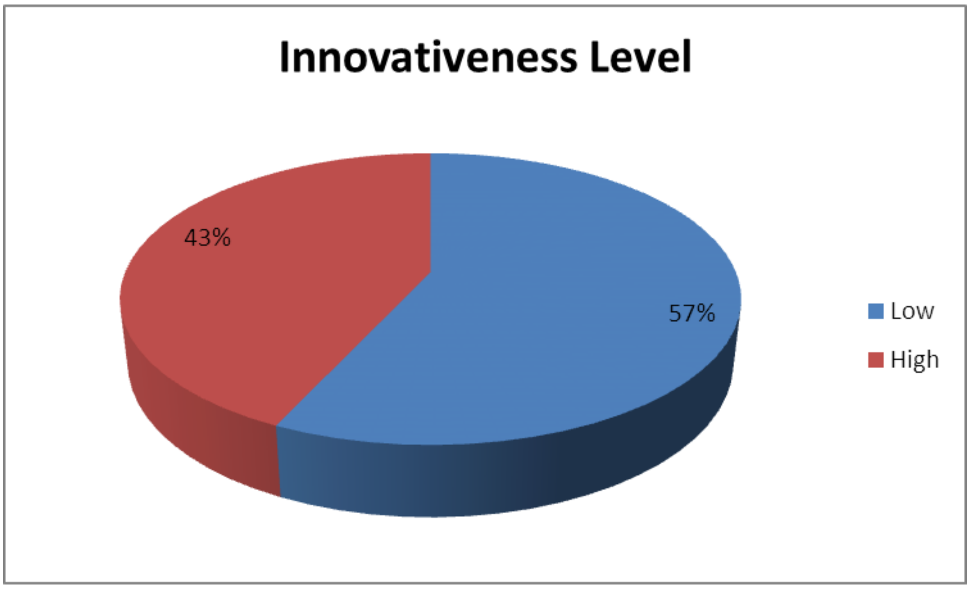


Figure 4.1 Percentages of pre-service early childhood teachers' innovativeness level.

Second, preservice early childhood teachers were categorized considering their individual innovativeness scores. As explained and displayed previously, Hurt et al. (1977), determined the cut-off scores for the adopter categories of the individuals. For example, the cut-off score for the innovators is "above 80"; for early adopters, "between 69 and 80"; for early majority, "between 57 and 68", for late majority, "between 46 and 56"; and for laggards, "below 46". On the basis of these cut-off scores, results of the present study showed that more than half of the preservice early childhood teachers were in the early majority group. Moreover, 28.7% of the participants were categorized as early adopters. While 11.3% of the preservice early childhood teachers were in the late majority group, the rest of the participants were in the innovator group rather than laggard group (see Table 4.7).

Table 4.7

Adopter Categories of the Preservice Early Childhood Teachers

Adopter Categories	***f***	**%**
Innovators	15	3.5
Early Adopters	125	28.7
Early Majority	241	55.3
Late Majority	47	11.3
Laggards	3	0.7

4.3 Research Question 3: Is there a difference between the preservice early childhood tecahers' adopter categories regarding the perceived attributes of computer use?

For this research question, one-way between-groups multivariate analysis of variance (MANOVA) was conducted. Although MANOVA is very similar to ANOVA, in MANOVA there are two or more continuous dependent variables that were affected by one or more categorical independent variables having two or more levels (Tabachnick & Fidell, 2007). Therefore, using MANOVA rather than separate ANOVAs for each the dependent variables would decrease the "Type I error" risk (Pallant, 2011). In the present study, there is more than one dependent variable such as relative advantage, compatibility, complexity, trialability, and observability and one independent variable having five levels such as innovators, early adopters, early majority, late majority, and laggards. Therefore, MANOVA was determined as the appropriate statistic. However, before conducting MANOVA the required assumptions were checked. According to Pallant (2007), there are seven main assumptions that are sample size, normality, outliers, linearity, homogeneity of regression, multicollinearity and singularity, and homogeneity of variance-covariance matrices. After ensuring these assumptions, the results of the MANOVA were presented in the following sub-titles.

4.3.1 The assumptions of the MANOVA.

To begin with sample size, according to Pallant (2007) the minimum number of cases for the each cell should be the number of the dependent variables. For this analysis, there are 25 cells (five levels of the independent variable and five dependent variables for each) in total. Thus, the minimum required cases should be one hundred twenty five. In the present study, there are more than required participants (*N* =430), therefore, the sample size is ensured.

Second, to assure normality assumptions, univariate normality were checked. Normal is defined as "a symmetrical, bell-shaped curve, which has the greatest frequency of scores in the middle with smaller frequencies towards the extremes" (Gravetter & Wallnau 2004, p. 48). For MANOVA as well as the other statistics, the distribution of the dependent variable scores should be checked whether it is 'normal' or not (Pallant, 2007). For this purpose, skewness and kurtosis values or shape of the distribution could be assessed. However, the tests used to evaluate skewness and kurtosis values are too sensitive with large samples (e.g. 200+), the shape of the distribution (e.g. histogram) is recommended to assess normality (Tabachnick & Fidell, 2007). Therefore, the histogram graphs were checked for the assessment of the normality. In the present study, except from one variable (Total_Complex) the distribution of scores appears 'normal' (see Appendix A). Since in social sciences, many scales and measures are generally skewed, this does not be problem for the scale (Pallant, 2007). Therefore, it can be stated that the distribution of scores was reasonably 'normal'.

Third, to assure outliers assumption, multivariate normality was checked and Mahalanobis distances were explored. For the present study, maximum value for Mahalonobis distance was found 25.50. This value was compared to the critical value 20.52 (Pallant, 2007). Since there were three cases that had higher Mahalanobis distance value than the critical value, these three cases (case 19, case 89, and case 379) were excluded from the analysis. Thus, the maximum value for Mahalonobis distance became as 19.81 which is under the critical value.

Fourth, for the linearity assumption, a matrix of scatterplots between dependent and independent variables was generated. For this purpose, the shape was examined to see a straight-line relationship between each pair of the variables. The scatterplots demonstrated that there are no serious violations of linearity assumption for each group (see Appendix B).

Fifth, homogeneity of regression assumption was skipped since it is important only if a step-down analysis is performed (Pallant, 2007).

Sixth, for the multicollinearity and singularity assumption, the correlation between the dependent variables was examined. According to Pallant (2007), the dependent variables should be moderately correlated and the correlations up around .8 or .9 are reason for concern. In the present study, correlation coefficients between the dependent variables range from .08 to .67, which were smaller than .8 (see Table 4.8). Therefore, this assumption was assured.

Table 4. 8

Correlation Coefficients between Dependent Variables

	Relative Advantage	Compatibility	Complexity	Observability	Trialability
Relative Advantage	-	.690**	.339**	.281**	.086
Compatibility	.690**	-	.383**	.319**	.207**
Complexity	.339**	.383**	-	.193**	.348**
Observability	.281**	.319**	.193**	-	.205**
Trialability	.086	.207**	.348**	.205**	-

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

Sixth, for the homogeneity of variance-covariance matrices, Box's M Test of Equality of Covariance Matrices was examined. According to Pallant (2007), if the Sig. value, in Box's M Test of Equality of Covariance Matrices, is larger than .001, the assumption is not violated. In the present study, sig. value was .000 which is lower than .001. That is, this assumption is violated. However, Tabachnick and Fidell (2007) state that if sample size is large (200+), Box's M could be too strict.

4.3.2 Multivariate analysis of variance (MANOVA).

As a result, a one-way between-groups multivariate analysis of variance was performed to investigate innovativeness differences in perceived attributes of computer use. Five dependent variables were used: relative advantage, compatibility, complexity, trialability, and observability. The independent variable was adopters as innovators, early adopters, early majority, late majority, and laggards. Preliminary assumption testing was conducted to assure normality, linearity, univariate and multivariate outliers, multicollinearity, and homogeneity of variance-covariance matrices. It was found that homogeneity of variance-covariance matrices assumption was violated. However, SPSS software offers some alternatives to interpret result of MANOVA. According to Tabachnick and Fidell (2007), "as sample size decreases, unequal *n*'s appear, and the assumption of homogeneity of variance-covariance matrices is violated, the advantage of Pillai's criterion in terms of robustness is more important" (p. 269). Therefore, in the present study, Pillai's Trace value was reported for the results.

The results of MANOVA showed that there was a statistically significant difference between adopter categories on the combined dependent variables, F (20, 1652) = 4.68, p = .00; Pillai's Trace = .21; partial eta squared = .05 (see Table 4.9).

Table 4.9

Multivariate Test

	Pillai's Trace	F	Sig.	Partial Eta Squared
Adopter_Groups	.214	4.677	.000	.054

In order to examine the statistical significance reducing Type 1 error, a follow-up analysis was examined. For this purpose, a Bonferonni adjustment has been applied and the dependent variables were considered separately. In this adjustment, original alpha level of .05 was divided by 5, the number of the dependent variables, and the new alpha level was found .01. When the Sig. values were compared using the Bonferroni adjusted alpha level of .01, the results showed that adopter categories are different from each other in terms of five perceived attributes, namely relative advantage, compatibility, complexity, trialability, and observability since all of the *p* values are smaller than .01. Moreover, according to Pallant (2007), the partial eta squared (η^2) shows a small effect if the value is .01; it shows a moderate effect size if the value is .06; it shows a large effect size if the value is .14. For this study, the partial eta squared (η^2) shows a moderate effect size for the attributes relative advantage (.06), compatibility (.06), complexity (.13), trialability (.08) since it is either .06 or bigger than .06. On the other hand, the partial eta squared (η^2) shows a small effect size for the observability (.04) since it is smaller than .06 and bigger than .01 (see Table 4.10).

Table 4.10

Multivariate Analysis of Variance for Perceived Attributes of Computer Use regarding Adopter Categories

Source	Dependent Variables	*F*	*p*	η^2
Adopter Category	Relative Advantage	6.143	.000*	.056
	Compatibility	6.352	.000*	.058
	Complexity	15.103	.000*	.127
	Trialability	9.124	.000*	.081
	Observability	3.891	.004*	.036

**Note*. Multivariate *F* ratios were generated from Pillai's statistic. *Sig*. alpha level was arranged as .01 by Bonferroni adjustment.

Although a significant difference was determined between adopter categories regarding five perceived attributes, it was still unknown which group has higher or lower score. Therefore, in order to understand which groups are different from the others, a follow-up univariate analysis of variances has been conducted and mean scores of the groups were examined.

4.3.2.1 Follow-up ANOVA results for relative advantage and adopter categories.

MANOVA results showed that there is a mean difference among the adopter categories regarding relative advantage, F (4, 414) = 6.143, $p < .01$, $\eta^2 = .056$. In order to understand, which groups are different from the others a follow-up univariate analysis of variances was conducted. Results showed that innovators, early adopters, and early majority were significantly different from late majority in terms of relative advantage (see Table 4.11).

Table 4.11

Multiple Comparisons - Tukey HSD

Dependent Variable	(I) Adopters	(J) Adopters	Mean Difference (I-J)	Std. Error	Sig.
Relative Advantage	Laggards	Late Majority	-.0994	.43679	.999
		Early Majority	-.4905	.42592	.779
		Early Adopters	-.6089	.42838	.614
		Innovators	-.9905	.46360	.207
	Late Majority	Laggards	.0994	.43679	.999
		Early Majority	-.3912*	.11826	.009
		Early Adopters	-.5095*	.12683	.001
		Innovators	-.8911*	.21795	.000
	Early Majority	Laggards	.4905	.42592	.779
		Late Majority	.3912*	.11826	.009
		Early Adopters	-.1184	.08192	.599
		Innovators	-.4999	.19526	.080
	Early Adopters	Laggards	.6089	.42838	.614
		Late Majority	.5095*	.12683	.001
		Early Majority	.1184	.08192	.599
		Innovators	-.3816	.20056	.318
	Innovators	Laggards	.9905	.46360	.207
		Late Majority	.8911*	.21795	.000
		Early Majority	.4999	.19526	.080
		Early Adopters	.3816	.20056	.318

* The mean difference is significant at the .01 (arranged by Bonferroni adjustment)

Furthermore, an inspection of the mean scores indicated that innovators (M = 4.56, SD = .19), early adopters (M = 4.18, SD = .07), and early majority (M = 4.06, SD = .05) had higher levels of relative advantage than late majority (M = 3.67, SD = .10), respectively (see Table 4.12).

Table 4.12

Mean Scores and Standard Deviations of Adopters Categories regarding Relative Advantage Attributes

	Adopters Categories	*M*	*SD*
Relative Advantage	Laggards	3.571	.423
	Late Majority	3.671	.108
	Early Majority	4.062	.048
	Early Adopters	4.180	.066
	Innovators	4.562	.189

4.3.2.2 Follow-up ANOVA results for compatibility and adopter categories.

MANOVA results showed that there is a mean differences among adopter categories regarding compatibility attributes, F (4, 414) = 6.35, $p < .01$, $\eta^2 = .058$. In order to understand, which groups are different from the others a follow-up univariate analysis of variances was conducted. Results showed that innovators were significantly different from early majority, late majority, and laggards in terms of compatibility attributes (see Table 4.13).

Table 4.13

Multiple Comparisons - Tukey HSD

Dependent Variable	(I) Adopters	(J) Adopters	Mean Difference (I-J)	Std. Error	Sig.
Compatibility	Laggards	Late Majority	-.8584	.47628	.374
		Early Majority	-1.1177	.46443	.116
		Early Adopters	-1.2309	.46711	.066
		Innovators	-1.8500*	.50552	.003
	Late Majority	Laggards	.8584	.47628	.374
		Early Majority	-.2592	.12896	.263
		Early Adopters	-.3725	.13829	.057
		Innovators	-.9916*	.23766	.000
	Early Majority	Laggards	1.1177	.46443	.116
		Late Majority	.2592	.12896	.263
		Early Adopters	-.1132	.08932	.711
		Innovators	-.7323*	.21292	.006
	Early Adopters	Laggards	1.2309	.46711	.066
		Late Majority	.3725	.13829	.057
		Early Majority	.1132	.08932	.711
		Innovators	-.6191	.21870	.039
	Innovators	Laggards	1.8500*	.50552	.003
		Late Majority	.9916*	.23766	.000
		Early Majority	.7323*	.21292	.006
		Early Adopters	.6191	.21870	.039

* The mean difference is significant at the .01 (arranged by Bonferroni adjustment)

Moreover, an inspection of the mean scores indicated that innovators (M = 4.56, SD = .19) had higher levels of compatibility than early majority (M = 4.06, SD = .05), late majority (M = 3.67, SD = .10), and laggards (M = 3.67, SD = .10), respectively (see Table 4.14).

Table 4.14

Mean Scores and Standard Deviations of Adopters Categories regarding Compatibility Attributes

	Adopters Categories	*M*	*SD*
Compatibility	Laggards	2.333	.461
	Late Majority	3.192	.118
	Early Majority	3.451	.052
	Early Adopters	3.564	.072
	Innovators	4.183	.206

4.3.2.3 Follow-up ANOVA results for complexity and adopter categories.

MANOVA results showed that there is a mean differences among adopter categories regarding complexity attributes, F (4, 414) = 15.103, $p < .01$, $\eta^2 = .127$. In order to understand, which groups are different from the others a follow-up univariate analysis of variances was conducted. Results showed that innovators and early adopters were significantly different from early majority, late majority, and laggards in terms of complexity attributes. Moreover, early majority group was significantly different from late majority group regarding complexity attributes (see Table 4.15).

Table 4.15

Multiple Comparisons - Tukey HSD

Dependent Variable	(I) Adopters	(J) Adopters	Mean Difference (I-J)	Std. Error	Sig.
Complexity	Laggards	Late Majority	-.9300	.41765	.172
		Early Majority	-1.3143	.40726	.012
		Early Adopters	-1.6466*	.40960	.001
		Innovators	-1.9556*	.44328	.000
	Late Majority	Laggards	.9300	.41765	.172
		Early Majority	-.3843*	.11308	.007
		Early Adopters	-.7167*	.12127	.000
		Innovators	-1.0256*	.20840	.000
	Early Majority	Laggards	1.3143	.40726	.012
		Late Majority	.3843*	.11308	.007
		Early Adopters	-.3324*	.07833	.000
		Innovators	-.6413*	.18670	.006
	Early Adopters	Laggards	1.6466*	.40960	.001
		Late Majority	.7167*	.12127	.000
		Early Majority	.3324*	.07833	.000
		Innovators	-.3089	.19177	.491
	Innovators	Laggards	1.9556*	.44328	.000
		Late Majority	1.0256*	.20840	.000
		Early Majority	.6413*	.18670	.006
		Early Adopters	.3089	.19177	.491

* The mean difference is significant at the .01 (arranged by Bonferroni adjustment)

Moreover, an inspection of the mean scores indicated that innovators (M = 4.51, SD = .18) had lower levels of complexity than early majority (M = 3.87, SD = .05), late majority (M = 3.49, SD = .10), and laggards (M = 2.56, SD = .41), respectively. Similarly, early adopters (M = 4.20, SD = .06) had lower levels of complexity than early majority (M = 3.87, SD = .05), late majority (M = 3.49, SD = .10), and laggards (M = 2.56, SD = .41), respectively. Lastly, the results indicated that early majority (M = 3.87, SD = .05) had lower levels of complexity than late majority (M = 3.49, SD = .10) (see Table 4.16).

Table 4.16

Mean Scores and Standard Deviations of Adopters Categories regarding Complexity Attributes

	Adopters Categories	*M*	*SD*
Complexity	Laggards	2.556	.405
	Late Majority	3.486	.103
	Early Majority	3.870	.046
	Early Adopters	4.202	.063
	Innovators	4.511	.181

**Note:For complexity, higher mean refers that it is less complex*

4.3.2.4 Follow-up ANOVA results for trialability and adopter categories.

MANOVA results showed that there is a mean differences among adopter categories regarding trialability attributes, F (4, 414) = 9.124, p < .01, η^2 = .081. In order to understand, which groups are different from the others a follow-up univariate analysis of variances was conducted. Results showed that early adopters were significantly different from early majority and late majority in terms of trialability attributes (see Table 4.17).

Table 4.17

Multiple Comparisons - Tukey HSD

Dependent Variable	(I) Adopters	(J) Adopters	Mean Difference (I-J)	Std. Error	Sig.
Trialability	Laggards	Late Majority	-.1261	.42585	.998
		Early Majority	-.4970	.41526	.753
		Early Adopters	-.8131	.41765	.294
		Innovators	-.7067	.45199	.522
	Late Majority	Laggards	.1261	.42585	.998
		Early Majority	-.3709	.11530	.012
		Early Adopters	-.6870*	.12365	.000
		Innovators	-.5806	.21249	.051
	Early Majority	Laggards	.4970	.41526	.753
		Late Majority	.3709	.11530	.012
		Early Adopters	-.3161*	.07986	.001
		Innovators	-.2097	.19037	.806
	Early Adopters	Laggards	.8131	.41765	.294
		Late Majority	.6870*	.12365	.000
		Early Majority	.3161*	.07986	.001
		Innovators	.1064	.19554	.983
	Innovators	Laggards	.7067	.45199	.522
		Late Majority	.5806	.21249	.051
		Early Majority	.2097	.19037	.806
		Early Adopters	-.1064	.19554	.983

* The mean difference is significant at the .01 (arranged by Bonferroni adjustment)

Moreover, an inspection of the mean scores indicated that early adopters (M = 3.41, SD = .07) had higher levels of trialability than early majority (M = 3.10, SD = .05) and late majority (M = 2.73, SD = .11) (see Table 4.18).

Table 4.18

Mean Scores and Standard Deviations of Adopters Categories regarding Trialability Attributes

	Adopters Categories	*M*	*SD*
Trialability	Laggards	2.600	.413
	Late Majority	2.726	.105
	Early Majority	3.097	.047
	Early Adopters	3.413	.065
	Innovators	3.307	.185

4.3.2.5 Follow-up ANOVA results for observability and adopter categories.

MANOVA results showed that there is a mean differences among adopter categories regarding observability attributes, F (4, 414) = 3.891, $p < .01$, $\eta^2 = .036$. In order to understand, which groups are different from the others a follow-up univariate analysis of variances was conducted. Results showed that innovators and late majority were significantly different from each other in terms of observability attributes (see Table 4.19).

Table 4.19

Multiple Comparisons - Tukey HSD

Dependent Variable	(I) Adopters	(J) Adopters	Mean Difference (I-J)	Std. Error	Sig.
Observability	Laggards	Late Majority	.0797	.54685	1.000
		Early Majority	-.1820	.53324	.997
		Early Adopters	-.3046	.53632	.980
		Innovators	-.9333	.58042	.493
	Late Majority	Laggards	-.0797	.54685	1.000
		Early Majority	-.2618	.14807	.394
		Early Adopters	-.3844	.15878	.112
		Innovators	-1.0130*	.27287	.002
	Early Majority	Laggards	.1820	.53324	.997
		Late Majority	.2618	.14807	.394
		Early Adopters	-.1226	.10256	.754
		Innovators	-.7513	.24446	.019
	Early Adopters	Laggards	.3046	.53632	.980
		Late Majority	.3844	.15878	.112
		Early Majority	.1226	.10256	.754
		Innovators	-.6287	.25110	.092
	Innovators	Laggards	.9333	.58042	.493
		Late Majority	1.0130*	.27287	.002
		Early Majority	.7513	.24446	.019
		Early Adopters	.6287	.25110	.092

* The mean difference is significant at the .01 (arranged by Bonferroni adjustment)

Furthermore, an inspection of the mean scores indicated that innovators (M = 4.35, SD = .24) had higher levels of observability than late majority (M = 3.34, SD = .14) (see Table 4.20).

Table 4.20
Mean Scores and Standard Deviations of Adopters Categories regarding Observability Attributes

	Adopters Categories	*M*	*SD*
Observability	Laggards	3.417	.530
	Late Majority	3.337	.135
	Early Majority	3.599	.060
	Early Adopters	3.721	.083
	Innovators	4.350	.237

In conclusion, one-way MANOVA results have indicated that preservice early childhood teachers who are in different adopter categories had different perceived attributes of computer use in early childhood education. For example, the preservice early childhood teachers who are in innovator and early adopter groups perceive that computer use in early childhood education provides more advantage than do late majority. Moreover, innovators perceive that computer use in early childhood education is more compatible than do early majority, late majority, and laggards. Furthermore, innovators perceive that computer use in early childhood education is easier than do early majority, late majority, and laggards. In addition, innovators perceive that computer use in early childhood education is more observable than do late majority. On the other hands, early adopters also perceive that computer use in early childhood education is easier than do early majority, late majority, and laggards. Moreover, early adopters perceive that computer use in early childhood education is more triable than do early majority. Lastly, the results indicated that early majority perceive that computer use in early childhood education is easier than do late majority. Besides these results, it could be concluded that the preservice early childhood teachers being in high level of adopter categories had high level of positive perception related to computer use in early childhood education.

4.4 Research Question 4: What are the preservice early childhood teachers' communication channel preferences to learn about computer use?

When preservice early childhood teachers were asked which communication channel(s) they prefer to obtain new information about computer use, as it is seen in Figure 4.8, majority of the preservice early childhood teachers tend to use interpersonal channels rather than mass media channels. Specifically, vast majority of the preservice early childhood teachers answered that the interactive computer course (75.4%) and the seminars or workshops (69.7%) are the important ways to learn about computer use. Moreover, more than half of the preservice early childhood teachers stated that learning from friends and family (57%) has an important role to get new information about computer use. On the other hand, preservice early childhood teachers prefer to use online computer journals (29.9%) and online computer books (27.8%) rather than printed computer journals (17.5%) and printed computer books (14%). Moreover, they think that television (23.7%) is an important communication channel. Finally, they responded the "others" option as "tutorials" and "experimenting on your own" to obtain new information about computer use.

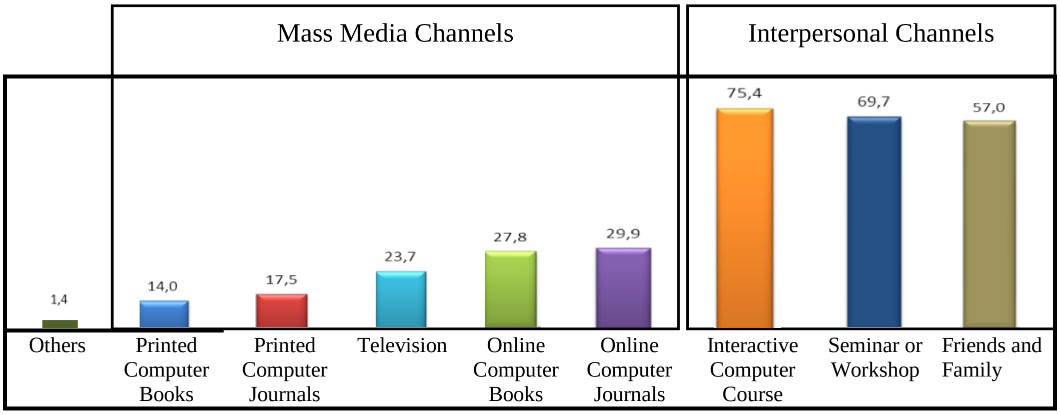


Figure 4.8 Percentages of communication channel preferences.

4.5 Summary

Based on Rogers' (2003) Diffusion of Innovations theory, the study had four purposes. First, the present study aimed to examine how preservice early childhood teachers perceive the attributes (relative advantage, compatibility, complexity, trialability, and observability) of instructional computer use. Second, the study aimed to determine the preservice early childhood teachers' innovativeness level and their adopter categories (innovators, early adopters, early majority, late majority, and laggards) based on their individual innovativeness level. Third, this study aimed to explore the differences between the preservice early childhood teachers' adopter categories regarding the perceived attributes of computer use for instructional purposes. Finally, the study aimed to describe the preservice early childhood teachers' communication channel preferences to learn about computer use.

The findings of the present study could be summarized within the four purposes of the study. To begin with, the results showed that preservice early childhood teachers perceived that computer use for instructional purposes (1) provides advantages, (2) is not complex, and (3) can be observed in early childhood settings. Moreover, they have both neutral and positive perception for the compatibility of the computer use for instructional purposes. However, they perceive that trialability of computers for instructional purposes is not sufficient for them.

Second, it was found that more than half of the preservice early childhood teachers were considered low in innovativeness level. Furthermore, in terms of adopter categories, the preservice early childhood teachers were placed in early majority, early adopter, late majority, innovator, and laggard groups, respectively.

Third, the results indicated that the preservice early childhood teachers who were grouped in five adopter categories were significantly different from each other regarding perceived attributes of computer use. For example, the preservice early childhood teachers who are in innovators and early adopter groups perceive that computer use in early childhood education provides more advantage than do late majority. Moreover, innovators perceive that computer use in early childhood education is more compatible than do early majority, late majority, and laggards. Furthermore, innovators perceive that computer use in early childhood education is easier than do early majority, late majority, and laggards. In addition, innovators perceive that computer use in early childhood education is more observable than do late majority. On the other hands, early adopters also perceive that computer use in early childhood education is easier than do early majority, late majority, and laggards. Moreover, early adopters perceive that computer use in early childhood education is more triable than do early majority. Lastly, the results indicated that early majority perceive that computer use in early childhood education is easier than do late majority. In addition to these findings, it could be concluded that the preservice early childhood teachers being in high level of adopter categories had high level of positive perception related to computer use in early childhood education.

Finally, the results showed that most of the preservice teachers preferred interpersonal communication channels rather than mass media channels.

CHAPTER V

DISCUSSION

The final chapter of this study is concluded in two parts. First, the findings of the data are interpreted by the previous research. Second, the possible implications are presented to describe more successful instructional computer use in early childhood education.

5.1. Conclusions from the Results of the Study

This study aimed to investigate the adoption of computer use in early childhood education. Specifically, purposes of the present study were to investigate preservice early childhood teachers' views related to perceived attributes of instructional computer use in early childhood education; to identify preservice early childhood teachers' innovativeness level and their adopter categories; to explore the differences between the adopter categories and perceived attributes of computer use in early childhood education; to describe preservice early childhood teachers' communication channel preferences for learning new information about computer technology.

5.1.1 Perceived attributes of instructional computer use in early childhood education.

Rogers (2003) states that perceived attributes of an innovation play a significant role in explaining the rate of adoption of this innovation. Indeed, Rogers (2003) indicates that up to 87 percent of rate of the adoption belongs to the perceived attributes. Hence, in order to determine how preservice early childhood teachers perceive instructional computer use in early childhood education, the data were collected by the Turkish version of PACU scale and analyzed by descriptive statistics. For this purpose, each component of the scale, namely, relative advantage, compatibility, complexity, trialability, and observability, was examined by the corresponded items. The results of the study demonstrated that preservice early childhood teachers perceived the instructional computer use as relative advantage. In other words, the preservice early childhood teachers think that using computers for instructional provide benefits in terms of productivity, effectiveness, performance, quality, and time-saving. Studies revealed that the attribute "relative advantage" is one of the strongest predictor and positively correlated to its rate of adoption (Rogers, 2003). That is, if people perceive that the new thing (an idea or an object) is advantageous in their life or their work, they intend to adopt this innovation (Kuşkaya-Mumcu, 2004). Moreover, the other result of this study showed that the preservice early childhood teachers perceived the instructional computer use is easy (i.e. not complex) to accomplish tasks. According to Rogers (2003), complexity is negatively correlated to the adoption of innovation. That is, if individuals feel difficulties while they use the innovation, they tend to reject this innovation. Furthermore, another result of the study demonstrated that the preservice early childhood teachers perceived the instructional computer use as observable. In other words, they state that instructional computer use is visible in early childhood education. On the other hand, preservice early childhood teachers indicated a neutral perception towards trialability of instructional computer use. That is, the preservice early childhood teachers think that they could not get enough opportunity to try various computer applications or programs prepared for early childhood education. Since the attribute "trialability" is positively related to rate of adoption, if the instructional computer use is enabled more triable for the preservice early childhood teachers, its rate of could be increased (Rogers, 2003). The last finding of this study showed that preservice early childhood teachers had both neutral and positive perception for the compatibility of the instructional computer use in early childhood education. That is, instructional computer use is almost compatible with the preservice early childhood teachers' beliefs and values to teach in early childhood education.

In brief then, in general, the preservice early childhood teachers' have positive views regarding perceived attributes of instructional computer use. This finding could be resulted from preservice early childhood teachers' access to computer (Mumtaz 2000; Sadera, 1997; Wilkes, 2001). In the present study, participants' demographic information related to computer use showed that almost all of the preservice teachers have computer Indeed, researchers found a significant relationship between computer ownership and computer use (Franklin, 2003; Isleem, 2003; Sahin, 2006).

In the present study, since the preservice early childhood teachers clearly believed that using computers in early childhood education is beneficial, not complex, and observable, it could be predicted that the adoption of instructional computer use will be high in their future teaching environment. This prediction is parallel to the study conducted by Aşkar and Koçak-Usluel (2003). In their study, they found that relative advantage and observability made differences on the rate of adoption of the computer use among the primary teachers during the two years. Similarly, some studies showed that a positive attitude toward an innovation contribute to its adoption (e.g. Almusalam, 2001; Blankenship, 1998; Brahier, 2006; Jacobsen, 1998; Zhao, Tan, & Mishra, 2001).

5.1.2 Innovativeness level of preservice early childhood teachers and their adopter categories.

In order to examine how innovative the preservice early childhood teachers are and which adopter category they have, the data were collected by IIS scale and analyzed by descriptive statistics. The results displayed that more than half of the preservice early childhood teachers are low in innovativeness level while almost half of them high in innovativeness level. This finding could be resulted from participants' computer expertise level since in the present study, the highest percentage of perceived computer expertise ranged between "incompetent" and "moderately competent" level. This conclusion can be supported by other studies. For example, some studies indicated that there is a significant relationship between computer expertise and participants' innovativeness level (Al-Senaidi, 2009; Braak, 2001; Jacobsen, 1998; Kılıçer, 2011; Zhao & Cziko, 2001). In addition, Rogers (2003) indicated that "earlier adopters have greater knowledge of innovation than do later adopters" (p.291) to describe differences among the potential adopters.

The other result of this study showed similarity with Rogers' (2003) bell-shape curve of adopter categories. According to Rogers (2003), the minority of the individuals were in innovators and laggards group while the majority of the people were in early adopter and early majority group. In the present study, more than half of the preservice early childhood teachers were categorized in early majority group and then in early adopter group. These findings were also confirmed by the other research studies (e.g. Hurt et. al, 1977; Kılıçer, 2011; Rogers 2003) which were presented in Table 5.1.

Table 5.1

Distribution of Adopter Categories

Adopter Categories	Hurt et. al (1977)	Rogers (2003)	Kılıçer (2011)	Present Study (2013)
Innovators	1.5%	2.5%	8.6%	3.5%
Early Adopters	13.5%	13.5%	37.8%	28.7%
Early Majority	34.9%	34%	42.2%	55.3%
Late Majority	34.9%	34%	10.1%	11.3%
Laggards	15.6%	16%	1.3%	.7%

In addition, as it is seen from Table 5.1, most of the preservice early childhood teachers grouped in early majority group. Moreover, in the study, the second largest group belonged to early adopter group. These findings of the study demonstrate a similarity with the previous research. For example, Kılıçer (2011) found that prospective teachers in computer education and instructional technology were mostly placed in early majority group and then in early adopter group. Similarly, Timucin (2009) found that most of the English teachers were categorized in the early majority group. According to Rogers (2003), early majority group is considered as a linker between the earlier adopters and the later adopters. Moreover, they rarely lead the other members of the system in the diffusion process. However, early adopter group has an important influence on their peers in terms of adopting the new ideas and they could be considered as a leader in the diffusion process. Therefore, this group of preservice early childhood teachers could contribute adoption and diffusion of instructional computer use in early childhood education.

5.1.3 Innovativeness level of preservice early childhood teachers and perceived attributes of instructional computer use.

The results of the present research were interpreted in terms of each component of perceived attributes and the preservice early childhood teachers' adopter categories based their innovativeness level. For this purpose, the data were examined to determine the possible differences between the adopter categories and the perceived attributes of computer use. The results indicated that there are significantly differences between the adopter categories and perceived attributes of computer use.

To begin with the relative advantage, the innovators and the early adopters, perceived that using computers for instructional purposes had more relative advantage than do late majority. Second, in terms of compatibility, the innovators perceived that using computers for instructional purposes is more compatible than do laggards, late majority, and early majority, respectively. Third, regarding the complexity, innovators and early adopter groups perceived that using computers for instructional purposes is less complex than do laggards, late majority, and early majority, respectively. In addition, early majority group perceived that using computers for instructional purposes is less complex than do late majority. Fourth, in terms of trialability, early adopters perceived that computers are more triable for instructional purposes than do early majority group. Finally, regarding observability attributes, the innovators perceived that instructional computer use is more observable than do late majority group.

Overall, it could be concluded that different adopter categories have different perceived attributes of computer use in early childhood education. Moreover, the preservice early childhood teachers having high innovativeness level (or placing in upper three adopter groups) have more positive attitude regarding the perceived attributes of computer use in early childhood education. One possible explanation of this conclusion was made by Rogers (2003) as stating “earlier adopters have a more favorable attitude toward change than do later adopters” (p.290). Moreover, previous studies that explored the possible differences between adopter categories and perceived attributes found parallel findings (e.g. Al Senaidi, 2009; Hoerup, 2001; Sahin, 2006). For example, Geoghegan (1995) concluded that while relative advantage was a significant attribute for the early adopters; complexity, compatibility, and trialability have a much stronger effect on the mainstream adopters (i.e. the early majority and the late majority).

5.1.4 Communication channels preferences of preservice early childhood teachers.

In the present study, most of the preservice teachers preferred interpersonal communication channels (e.g. interactive computer courses, friends and family, seminars or workshops) rather than mass media channels (e.g. television, printed computer books, printed computer journals, online computer books, and online computer journals).

Moreover, it was demonstrated that interactive computer courses and the seminars or workshops were the most preferred communication channels by the preservice early childhood teachers. In addition, more than half of the preservice early childhood teachers stated that learning from friends and family play an important role to get new information about computer use. Since majority of the preservice teachers were grouped in earlier adopters, this result could be resulted by preservice early childhood teachers' adopter categories. Indeed, Rogers (2003) describe adopters' general communication behavior in Generalization 7-18: as "earlier adopters have more social participations than do later adopters" (p. 290) and in Generalization 7-23: as "earlier adopters have greater exposure to interpersonal communication channels than do later adopters" (p.291). Similar to these findings, Romano (2010) also found that early adopters perceive talking with family and friends and taking face-to-face workshops as the most useful ways to learn about technology.

5.2 Educational Implications for Practice

5.2.1 Implications related to perceived attributes of computer use.

In the "10th Five Year Development Plan 2014-2018" of the Turkish Ministry of Development (2013), the article 732 indicates that "the awareness about social and economic advantages of the use of information and communication technologies will be increased and the skills related to these technologies will be developed" (p.111). That is, the government aims to make individuals be aware of the advantages of using technology. In the present study, most of the preservice early childhood teachers stated that using computers provide advantages in early childhood education. However, in order to increase their skills related to instructional computer use, some working-examples could be presented by in-service training. For example, a non-profit organization MirandaNet, established in 1992, provides a forum where educators can share experience and thoughts about the use of ICTs in teaching and learning environments within their own practice (MirandaNet, 2013, UNESCO, 2002). Hence, such this training the individuals could find out how they can arrange their own conditions and teaching environment.

In addition, the faculty members play a role model for the preservice teachers regarding computer use in instructional settings (Lortie, 1975; Ellis, 2004). Indeed, OTA (1995) makes a conclusion as “telling students about what is possible is not enough; they must see technology being used by their instructors, observe uses of technological tools in classrooms, and practice teaching with technologies themselves if they are to use these tools effectively in their own teaching” (p.185). Therefore, in order to increase observability attribute, early childhood faculty members are recommended to use new technologies in their teaching environments.

Moreover, early childhood education program can be revised to promote use of computers and related technology. For example, the International Reading Association (IRA, 2002) realized the link between language and ICT and encouraged the educators for integrating literacy and technology in the curriculum. Therefore, the early childhood education program can cover an example of daily plan related to computer based applications. Moreover, in order to teach the related words or concepts, a detailed learning process of the activity could be added in program. Hence, attributes of computer technology (e.g. relative advantage, complexity, and trialability) could be perceived more favorable to lead adoption of computer use in early childhood education.

Moreover, since the preservice early childhood teachers had neutral perception on trialability of instructional computer use, the courses given in early childhood departments should facilitate the trial of computer applications. For example, the courses such as instructional technology and material development could be enriched to experience required applications for creating computer-based or technology-based teaching materials. Indeed, UNESCO (2008) stated that “Schools and classrooms, both real and virtual, must have teachers who are equipped with technology resources and skills and who can effectively teach the necessary subject matter content while incorporating technology concepts and skills” (p. 3). Similarly, the International Society for Technology in Education (ISTE) which believes that educational computing and technology basics are crucial for all teachers and developed some standards to meet these foundations. In the paper, *ISTE National*

Educational Technology Standards (NETS) and Performance Indicators for Teachers, it was indicated that the teachers should "facilitate technology-enhanced experiences that address content standards and student technology standards, use technology to support learner-centered strategies that address the diverse needs of students" (ISTE-NETS, 2000). Hence, the preservice early childhood teachers would be graduated as trained teachers in terms of instructional computer use. Moreover, since field experiences have a positive impact in the preparation of the teachers (Huling, 1998), the other courses such as school experience and practice teaching could be revised to create a computer-based activity plan. For this purpose, standards of the United Nations Educational, Scientific and Cultural Organization (UNESCO) could be inspired to organize these courses. For example, UNESCO (2008) states "Teachers must have a firm knowledge of the curriculum standards for their subject, as well as knowledge of standard assessment procedures. In addition, teachers must be able to integrate the use of technology and technology standards for students into the curriculum… Teachers must be able to use technology with the whole class, small groups, and individual activities and assure equitable access" (p.10). In this way, the preservice early childhood teachers could get opportunities to apply a variety of technology enhanced activities in their practicums.

5.2.2 Implications related to innovativeness and adopter categories.

In terms of innovativeness level, the preservice early childhood teachers showed a-low level innovativeness. Moreover, in terms of adopter categories, half of the preservice early childhood teachers were categorized in early majority group and then some of them placed in early adopter group. According to Goldsmith and Foxall (2003), innovativeness level is a reaction toward the innovation as well as it is the previous condition of the innovation-decision process (Rogers, 2003). Thus, in order to increase innovativeness level of the prospective early childhood teachers, some activities related to "innovation", "innovativeness", and "being innovative" could be applied. For example, according to Ismail (2005) there is a significant effect of encouraging climate on the innovativeness. Therefore, “optimal” learning environments could be provided for the preservice early childhood teachers. Csikszentmihalyi (1990) explains this optimal environment as flow experince. According to Csikszentmihalyi (1990), people in flow get a sense of discovery, a creative feeling of moving into a new reality, and an urge for a higher level of performance. In order to make people be in flow channel, the activities or assigments should match with the challenges of the task as well as the skills of people (see Figure 5.1).

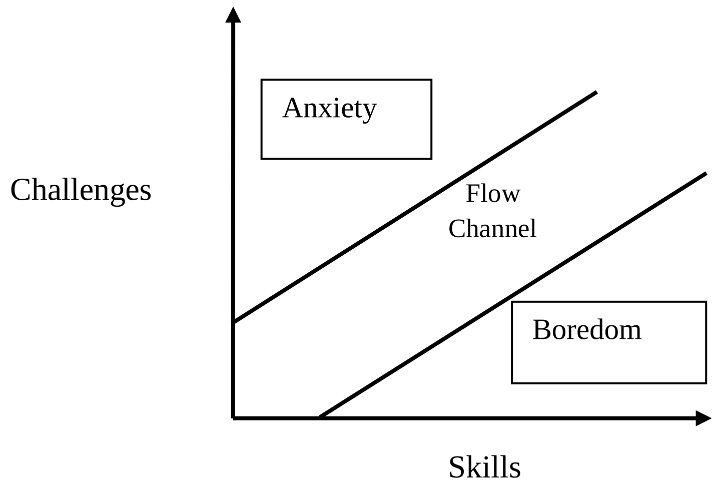


Figure 5.1 Flow experience (Csikszentmihalyi, 1990).

To expound, if the task is too difficult and the person is incompetent, then the person feels anxiety during the process. On the other hand, if the task is too easy and the person is competent, then the person feels boredom during the activity. That is, the optimal situation accommodates the people in flow channel and engages them in the activities (Csikszentmihalyi, 1990). Therefore, the faculty could provide optimal learning environments to support preservice early childhood teachers' innovativeness. In addition, in Oklahoma State University, a two-semester course named “innovation course” was given to undergraduate students to understand the innovations experience. Moreover, the related topics such as leadership, communications, and motivation were included in the course. During the innovation course, lectures, hands-on learning opportunities, and personal conversations were used as teaching methods and students were incorporated in real-world innovation projects. The aim of this course was to teach the students about the innovations process (Riggs et al., 2010). Therefore, a similar course can be added in early childhood teacher education programs. Moreover, preservice early childhood teachers can be informed about the seminars or workshops held on mentioned topics. Furthermore, prospective early childhood teachers could be participated in research and development projects in order to produce and implement new ideas.

5.2.3 Implications related to communication channels preferences.

Moreover, since most of the preservice early childhood teachers preferred to use interpersonal channels, these good examples could be given by their peers. Thus, more experienced and successful peers could provide necessary information and support to improve level of computers use in early childhood education.

Furthermore, as it was seen from the information related to computer use, most of the preservice early childhood teachers indicated low rate for the use of other technology such as whiteboards and tablet PCs. Since FATIH project aims to promote technology use in educational settings including the schools from preschool to high school, the awareness of these technologies could be increased by using mass media channels to reach a large number of audiences (Rogers, 2003). Specifically, in the present study, online computer books, online computer journals, and the television were mostly preferred source of information by the preservice early childhood teachers.

5.3 Recommendations for Future Research

This study investigated to determine adoption of instructional computer use, and it was found that computer use appears to be adopted and diffused among prospective early childhood teachers. A further study could be done to examine adoption of other technologies such as whiteboards and tablet PCs by both preservice and in-service early childhood teachers.

Moreover, in order to understand the commonalities and differences better, an in-depth case study can be conducted to profile preservice early childhood teachers' adopter categories.

According to Rogers (2003), adopter categories show differences in terms of communication behavior, socioeconomic status, and personality values. Therefore, except from communication behavior, the other factors (personal attributes and socioeconomic status) could be examined to describe adopter categories.

As mentioned previously, the faculty members are role model for the preservice teachers therefore a further study could be conducted to explore the early childhood academics' instructional computer use adoption and their innovativeness level.

The Turkish version of the perceived attributes of computer use (PACU) is properly applicable to the data gathered from the participants studying at the universities in Ankara. However, in order to utilize this scale all over the country and generalize to all preservice early childhood teachers, a further study could be done including different universities from all regions of Turkey.

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Appendix A: Normality Assumptions of MANOVA

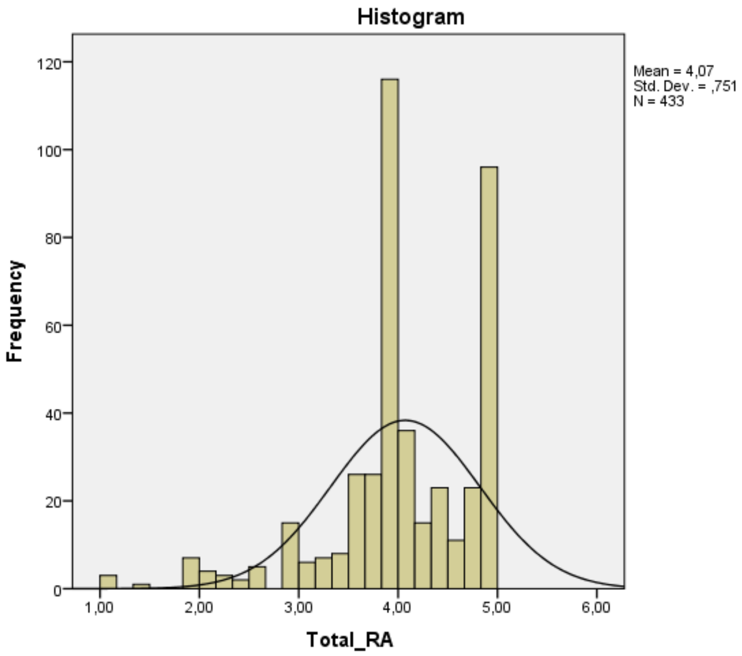

Figure 1. Distribution of relative advantage scores.

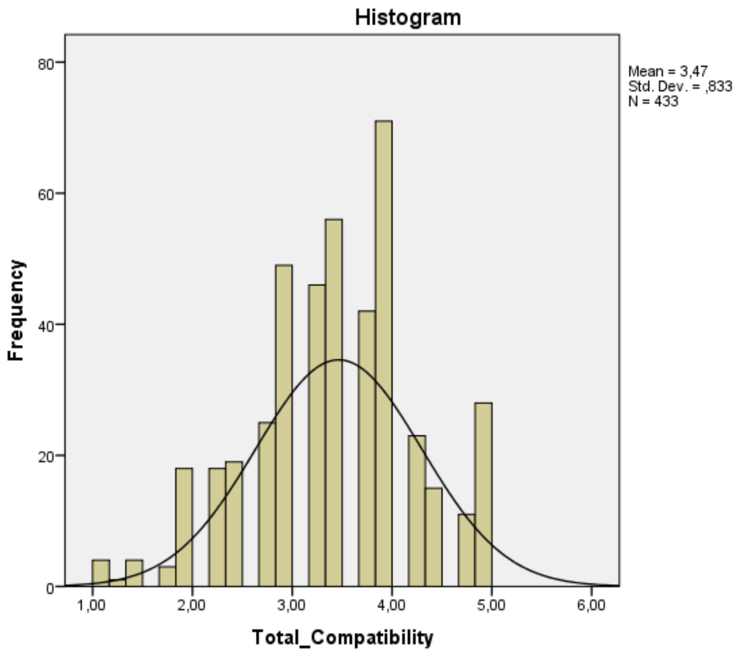

Figure 2. Distribution of compatibility scores.

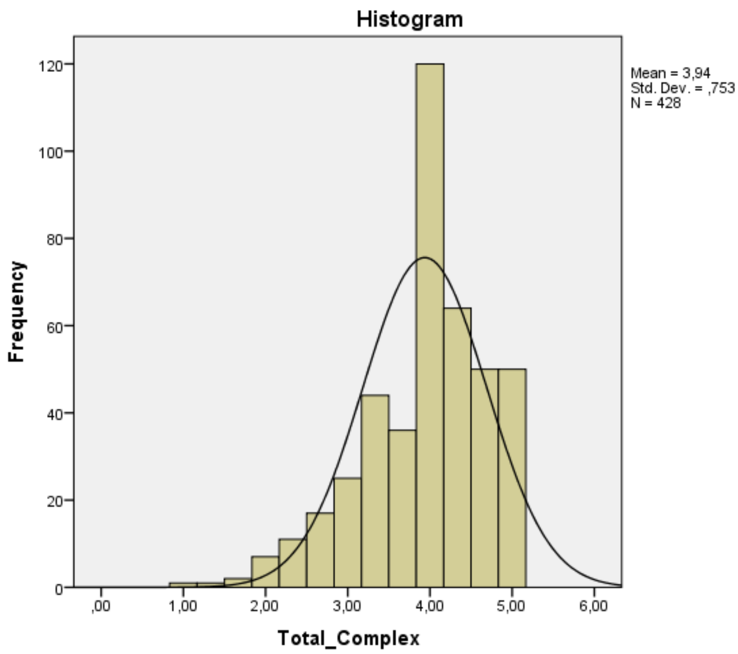

Figure 3. Distribution of complexity scores.

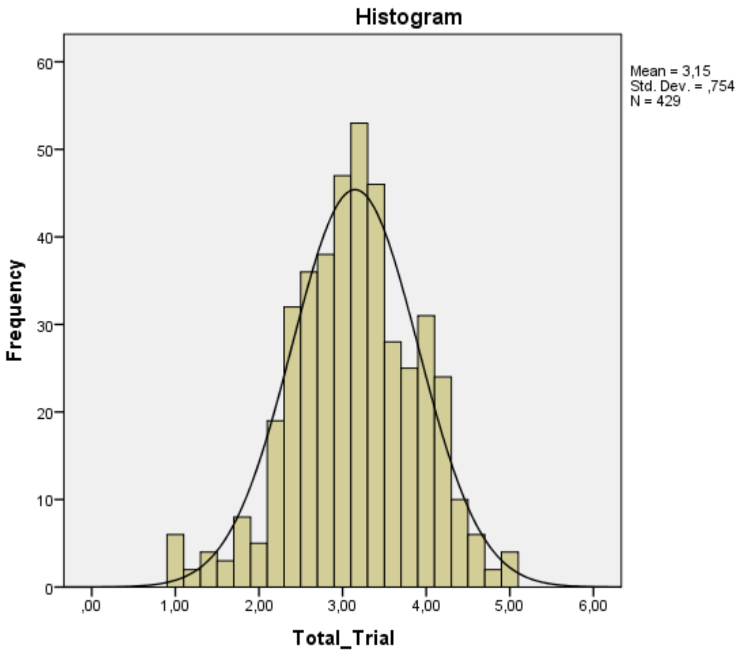

Figure 4. Distribution of trialability scores.

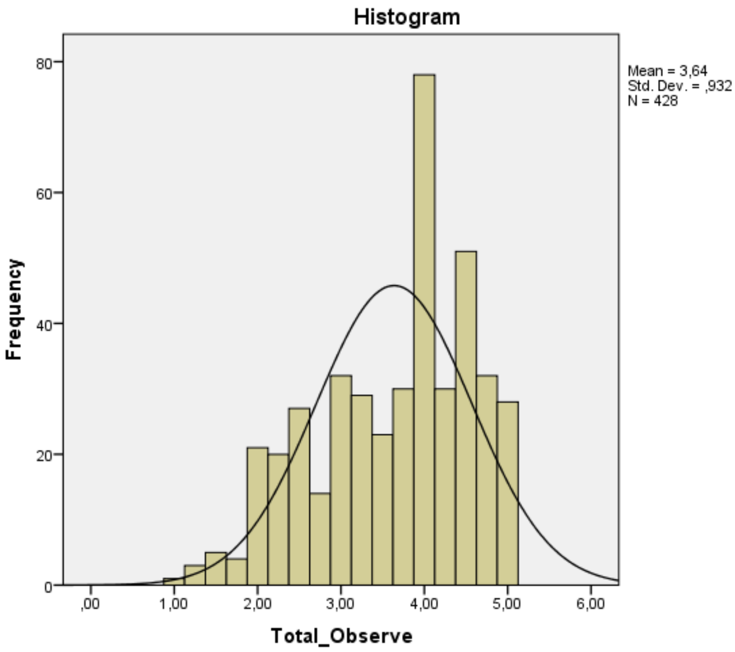

Figure 5. Distribution of observability scores.

Appendix B: Linearity Assumption of MANOVA

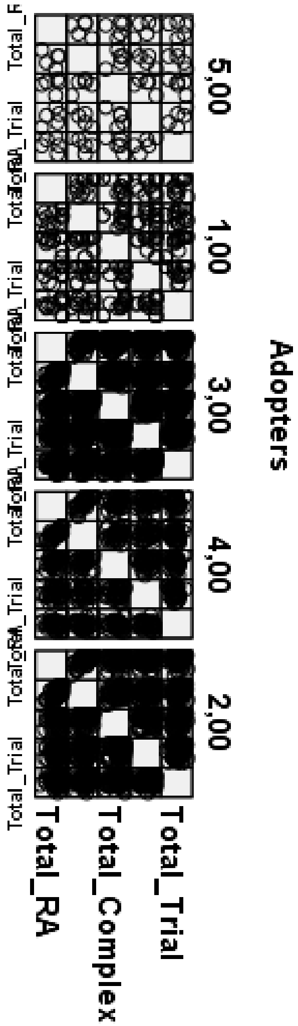

Figure 6. Scatterplots for each group.

Appendix C: METU Ethics Committee Permission

UYGULAMALI ETİK ARAŞTIRMA MERKEZİ
APPLIED ETHICS RESEARCH CENTER

ORTA DOĞU TEKNİK ÜNİVERSİTESİ
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20 Mart 2013

Gönderilen: Yrd. Doç.Dr.Refika Olgan
İlköğretim Bölümü

Gönderen : Prof. Dr. Canan Özgen
IAK Başkanı

İlgi : Etik Onayı

Danışmanlığını yapmış olduğunuz İlköğretim Bölümü Araştırma Görevlisi Nursel Yılmaz'ın "An Investigation of Pre-service Early Childhood Teachers' Levels of Individual Innovativeness and Their Perceived Attributes Regarding The Instructional Computer Use" isimli araştırması "İnsan Araştırmaları Komitesi" tarafından uygun görülerek gerekli onay verilmiştir.

Bilgilerinize saygılarımla sunarım.

Etik Komite Onayı

Uygundur

20/03/2013

Prof.Dr. Canan ÖZGEN
Uygulamalı Etik Araştırma Merkezi
(UEAM) Başkanı
ODTÜ 06531 ANKARA

Appendix D: Tez Fotokopisi İzin Formu

TEZ FOTOKOPİSİ İZİN FORMU

ENSTİTÜ

Fen Bilimleri Enstitüsü	
Sosyal Bilimler Enstitüsü	X
Uygulamalı Matematik Enstitüsü	
Enformatik Enstitüsü	
Deniz Bilimleri Enstitüsü	

YAZARIN

Soyadı : YILMAZ

Adı : Nursel

Bölümü : İlköğretim Bölümü Okul Öncesi Eğitimi

TEZİN ADI (İngilizce) : An Investigation of Preservice Early Childhood Teachers' Levels of Individual Innovativeness and Perceived Attributes of Instructional Computer Use

TEZİN TÜRÜ : Yüksek Lisans [X] Doktora [ ]

1. Tezimin tamamından kaynak gösterilmek şartıyla fotokopi alınabilir.	
2. Tezimin içindekiler sayfası, özet, indeks sayfalarından ve/veya bir bölümünden kaynak gösterilmek şartıyla fotokopi alınabilir.	
3. Tezimden bir (1) yıl süreyle fotokopi alınamaz.	X

TEZİN KÜTÜPHANEYE TESLİM TARİHİ: